ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.
Vol. XXXIV, No. 23.

TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK.....353, 367
The Rome Accident on the New York Central R. R. (illustrated) 354
Steel Ties on the Normanton & Croydon Ry., Queensland 354
The Canadian Pacific Railway as Seen by an Engineer (illustrated)..... 355
The New United States Government Lock at Sault Ste. Marie (with inset) (illustrated)..... 356
The Transverse Strength of Cast Iron and its Shrinkage in Cooling (illustrated)..... 357
Ballasting for Four-Track Work, New York, New Haven & Hartford R. R. (illustrated)..... 358
Rubble Concrete Work at Wright's Tunnel, Southern Pacific R. R. (illustrated)..... 359
Replacing Trestles with Earthwork, Canadian Pacific Ry. (illustrated)..... 364
Standard Highway Bridge of Steel Rails, Baltimore & Ohio R. R. (illustrated)..... 365
The Use of Machinery in Iron and Steel Works.. 365
The Highest Railway in the World..... 365
The Lane & Bodley Throttling Compound Engine (illustrated) 366
An Apparatus for Determining the Form of the Exhaust Jet (illustrated)..... 366
Weather Report for October..... 366
The Report of the Nicaragua Canal Commission.. 367
EDITORIAL NOTES.....360, 361
The Report of the Nicaragua Canal Commission—The Work of Train Wreckers at Rome, N. Y.—Why the Manhattan Elevated Earnings have Fallen Off—Freight Charges on the Southern Pacific Ry.—Senator Chandler's Dilemma—The Use of Large Rubble in Concrete—A Deserved Pension to an Engineer—The Effect of Silicon on Cast Iron—The Best Plan for Securing Compensation for City Franchises—Vacancies in the Bureau of Steam Engineering.
EDITORIAL:
Replacing Trestles with Earthwork..... 361
LETTERS TO THE EDITOR..... 363
Publisher of "Transportation Exhibits"—Sticking Paper to Metal or Glass—Car Wheel Tests at the Griffin Machine Works—Longitudinal Angle Stiffeners for Chords of Plate Girders—Electric Cars on Steam Railways—Defective Cast Iron Columns in the City Hall, St. Louis, Mo. (illustrated)—Stamping Titles on Tracings.

An advance statement of the earnings of railways in the United States for the fiscal year ending June 30, 1895, has been sent to us by the Statistician to the Interstate Commerce Commission. The statement shows that in the year covered by the report the earnings and expenditures were almost the same as in the previous year, which, it will be remembered, showed a great falling off from the record in the year ending June 30, 1893. The figures given cover 650 roads, with a total of 164,529 miles of railway, or 92% of the total mileage in the United States. The gross earnings were $1,003,022,853, of which $293,465,792 were from passenger service, $683,022,988 from freight service, and $26,217,595 were other earnings from operation, covering earnings from telegraph, car mileage balances, switching charges, etc. The operating expenses were $677,667,635, leaving net earnings of $325,355,218, as compared with net earnings of $320,137,670 for the same roads in 1894. Reduced to a mileage basis, gross earnings were $6,096, operating expenses were $4,119, and net earnings were $1,977; or a decrease in gross earnings of $13 per mile, as compared with 1894, and of $1,094 per mile as compared with 1893; a decrease in operating expenses of $44 per mile as compared with 1894, and of $757 per mile as compared with 1893. Net earnings show a gain over 1894 of $31 per mile of line, but a decrease of $337 per mile as compared with 1893. Passenger receipts fell off $177 per mile as compared with 1894, while freight receipts show a gain of $149 per mile. Passenger receipts were $336 per mile less than in 1893, and freight receipts show a decrease as compared with that year of $755 per mile. Income from sources outside of the operations of the roads was $33,057,243, making a total income available for the payment of fixed charges and dividends of $358,412,461. Total deductions from income, including fixed charges, were $336,351,946, and dividends paid were $53,135,545, leaving a deficit from the operation of the year of $31,075,030. The dividends paid by the same roads the preceding year were $61,504,785.

The new "Joint Traffic Association," which is to succeed the old Trunk Line Association, is said to be about perfected, all the companies interested having signified their approval of the proposed agreement. This provides, in brief, that a board of managers of nine members is to be charged with the duty of securing to each company equitable proportions of the competitive traffic, so far as this can be legally done. Each company deposits $5,000 with the managers, and for any violation of the terms of the agreement a forfeit not exceeding $5,000 will be demanded unless the transaction complained of exceeds $5,000 in value, when the forfeit may equal the amount. The managers are to formulate rules, and a permanent board of arbitration is to be instituted, consisting of three disinterested persons.

An eight-wheel passenger engine built by the Rogers Locomotive Works, of Paterson, N. J., for the Florida Central & Peninsular R. R., and exhibited at the Atlanta Exhibition, has the following general dimensions:

Driving wheels	5 ft. 9 ins.
Truck "	2 " 9 "
Tender " (Fox steel trucks)	2 " 9 "
Wheelbase, driving	9 " 1 in.
" engine	23 " 6 ins.
" engine and tender	49 " 9 "
Weight on driving wheels	69,000 lbs.
" of engine	108,000 "
Cylinders	18 × 26 ins.
Connecting rod, length	7 ft. 1 in.
Boiler (extended wagon top), diam.	4 " 10 ins.
" pressure	200 lbs.
Firebox	6 ft. 5 11-16 ins. × 3 ft. 5⅝ in.
Tubes....number, 248; diam. (out.), 2 ins.; length, 11 ft.	
Heating surface, total	1,513 sq. ft.
Grate area	22½ " "
Capacity of tender tank	4,000 gals.
Coal capacity of tender	6 tons.

Cast steel frames for six-wheel switch engines and an eight-wheel passenger engine have been made for the St. Louis Southwestern Ry. by the American Steel Foundry Co., of St. Louis, Mo. The frames are of the usual form, and in the switch engine frames the main casting is 22 ft. 9¼ ins. long, the top bar being 4 × 4 ins., and the lower bar (connecting the lower ends of the pedestals), 2½ × 4 ins. The total length of the frame is 28 ft. ½ in. The use of these frames was decided upon by Mr. R. M. Galbraith, Superintendent of Motive Power, on account of the reduced cost, while the strength is claimed to be greater than that of the forged frames.

The new corridor cars now being built by the Great Western Ry., of England, will approximate somewhat to the comforts of American cars, as far as cars with public compartments and seats face to face can do so. They will be lighted by compressed gas, as usual, and heated by steam from the locomotives, which is unusual, while mechanical exhaust ventilators will be used and the sliding window sashes will be fitted with "draft excluders." The automatic vacuum brake is used. The cars are 58 ft. long and 8 ft. 6 ins. wide over the body, and are mounted on steel frames carried on four-wheeled trucks. Each car will have a first-class compartment, with smoking-room and lavatory, a second-class compartment and lavatory, and four third-class compartments, with two lavatories (for men and women). There is also a baggage compartment. The cars will accommodate each 9 first-class, 7 second-class and 32 third-class passengers, and will be handsomely upholstered and decorated, the decorations including colored photographs of scenery along the line. These cars are intended especially for through service to places on other roads, the passengers and their baggage thus going through without change.

The specifications for 50-lb. rails for the Prince Edward Island Ry., and 67-lb. rails for the Intercolonial Ry., call for Bessemer steel of the following chemical composition: Carbon, 0.35 to 0.4%; silicon, 0.09%; manganese, 1%; phosphorus, 0.08%. The drop tests are made on 12-ft. lengths, placed on iron supports 3 ft. 6 ins. apart, and the rail must stand without fracture a blow from a ball weighing one ton falling 18 ft. (or 15 ft. for 50-lb rails), a deflection of 3 to 3¼ ins. being aimed at, but not exceeding 4 ins. for 67-lb., or 4¾ ins. for 50-lb. rails. Another portion of the rail, similarly supported, must stand three blows from a ball weighing one ton, with a drop of 6 ft. and a deflection of not less than 2¼ ins. or more than 3¼ ins., for 67-lb. rails, and a drop of 5 ft. and a deflection of not less than 3 ins. or more than 4¼ ins., for 50-lb. rails. These rails are to be guaranteed for seven years from the date of laying them in the track.

Relaying 75-lb. steel rails in place of 56-lb. rails, is now in progress on the Kansas City, Fort Scott & Memphis R. R., and Mr. M. T. Fitzpatrick, Roadmaster, informs us that the rails are renewed one at a time, instead of in strings, this practice being necessitated by the use of the American continuous rail joint. There are about 40 men in a gang: 15 drawing spikes, 12 handling rails, 4 spikers, 2 nippers and 2 flagmen, the remainder putting on the angle bars. When the rail handlers catch up with the spike pullers, they go back and put on angle bars. While waiting for trains, the gang attend to the full bolting, cut the old rails, and do enough spiking to make the track safe until the time for surfacing track, when the spiking is finished.

The abolition of grade crossings is now being actively discussed at Washington, D. C., and Bridgeport, Conn. At Washington, a report by a committee of the Board of Trade states that in the last four years 26 people have been killed and 36 injured at Pennsylvania R. R. crossings, and 14 killed and 19 injured at Baltimore & Ohio R. R. crossings. The committee strongly recommends the elevation of the tracks. The plan proposed for elevating the tracks at Bridgeport, from Fairfield Ave. to Central Ave., as submitted by the New York, New Haven & Hartford R. R., involves a cost of from $1,500,000 to $2,000,000, but no definite action has yet been taken.

The most serious railway accident of the week, and news of which reaches us as we go to press, occurred on the Atchison, Topeka & Santa Fe Ry., near Shoemaker, N. M., on Nov. 26. Two mail clerks were killed and 19 persons were injured, two fatally.

The investigation of the terrible accident at Cleveland, O., where an electric car went into an open draw, as described last week, is said to have shown that besides the derailing switch there was an apparatus for automatically cutting off the current at about 250 ft. from the draw whenever the draw was open, but that this apparatus had been out of order for some weeks. A device of this kind is probably the surest preventive of such accidents, but, like any other safeguard, its temporary disuse is always extremely dangerous. Mr. Geo. H. Benzenberg, M. Am. Soc. C. E., City Engineer of Milwaukee, Wis., has suggested that the current for the wires on the bridge and approaches should be generated by a dynamo in the engine house of the draw, in which case it would be impossible to run a car on the approach unless the draw was closed. Audible signals, collision gates, and derailing switches operated by a lever under the gates on the approach are among the safety devices suggested.

A serious fire occurred in the Dry Goods & Woolen Exchange Building, at Chicago, Ill., Nov. 22, in which four firemen were killed by the falling in of the floors. The loss is estimated at $100,000 on the building and $300,000 on the property of the tenants.

A steam pipe explosion, in which one man was instantly killed and one fatally injured, occurred at the new Olympia Theatre building in New York city, Nov. 26. The explosion occurred in the cellar of the building, and while its force was sufficient to shake the whole structure, the building was not damaged. The accident is similar to that which recently happened at the Brush Electric Light Station in New York city, described in our last week's issue. In the present instance the failure occurred at an elbow in a branch leading from the main steam pipe to a large heater. The steam pressure was low at the time of the accident, and it is safe to attribute the failure to water-hammer, presupposing proper pipefitting.

The recent disastrous boiler explosions in Denver, Colo., and in Detroit, Mich., have caused the authorities in both cities to adopt vigorous measures to diminish the liability to such disasters in future. In Denver an act has been passed requiring all those in charge of boilers to be licensed. The licensing board is to consist of a stationary engineer, a boiler maker and a machinist. A first-class license entitles the holder to take charge of any boiler; a second-class license, boilers not over 150 HP.; and a third-class license, boilers not over 50 HP. In Detroit the city officials are trying to frame an ordinance providing for the inspection of all boilers within the city limits. A committee of engineers has submitted a draft of an ordinance which provides that the chief inspector shall be an engineer of not less than ten years' standing. Some opposition to this ordinance has been made by parties who hold that a boilermaker, and not an engineer, is the proper sort of man to look after boilers.

A cylinder head was blown out of a Ball engine in the Edison electric plant at Eighth and Plum Sts., Cincinnati, O., on Nov. 18, tearing a hole 6 × 12 ft. through the wall of the engine house. No one was injured. The cause is supposed to have been a loose bolt in the piston.

The location of the New York and New Jersey bridge terminal in New York city was contested before the Sinking Fund Commission on Nov. 20. The attorney of the New York Central & Hudson River R. R. Co. contended that the location of the bridge pier at 69th St. would destroy the facilities at Pier 1 for the transfer of merchandise from steamships to railway cars. The location between 60th and 70th Sts. was also objected to because the land is already held for public use by a corporation, and the law does not permit usurpation by another corporation. The attorney for the bridge company argued that the Federal acts gave the right to subsequent companies to use land as they saw fit, and the desired location was at 69th St. The Commission, after the hearing, unanimously resolved not to permit the use of 69th St. for a pier; but it gave the right to use the waterfront between 59th and 60th Sts.

Paving blocks made from marsh grass are being tried at Norfolk, Va., about 200 sq. yds. having been laid recently. The grass is pressed dry in long blocks, in a baling machine, then sawed into slabs and each slab bound with wire and then floated through a trough of hot oil. Better results might be expected if the grass were treated with oil before pressing, and this may perhaps be done, as the works are not yet fully developed. W. I. P. Audre Motter is the agent at Norfolk.

THE ROME ACCIDENT ON THE NEW YORK CENTRAL R. R.

In our last issue we briefly recorded the circumstances of the terrible accident which occurred on the New York Central R. R. near Rome, N. Y., Nov. 19, which was caused by four youthful train wreckers. These boys, whose ideas seem to have been perverted by reading vicious literature of the "Jesse James" order, determined to wreck a train and rob the passengers. They broke open a section tool house and supplied themselves with tools with which they removed the bolts and spikes from two opposite rails. Armed with revolvers, they then waited near the place, but as soon as the accident happened they appear to have for the first time realized the enormity of their crime, and instead of "holding up" the uninjured passengers, they ran away in fright. They were all caught, however, and it is stated that ample evidence has been secured to convict them of murder in the first degree. It is to be hoped that they will be promptly punished to the full extent of the law, as a lesson to similar lawless characters.

Fig 1. General View of Wreck.

Fig. 2. View Showing Wrecking of End of Platform

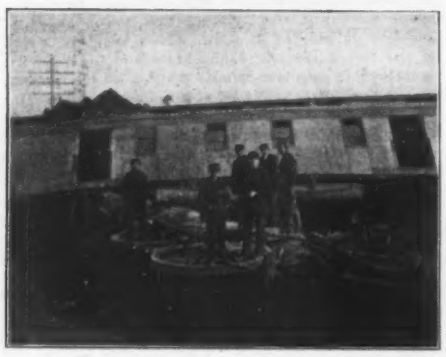


Fig. 3. The Wrecked Locomotive

Fig. 4. Wrecked Postal Cars near Center of Train.

THE RESULTS OF TRAIN WRECKERS' WORK ON THE NEW YORK CENTRAL R. R. NEAR ROME, N. Y., NOV. 19.

Fig. 1 shows the site of the accident, with the general position of the cars, the rear car, which remained on the track, being seen on the left. The train at the right is standing on the track parallel with that on which the wrecked train was running. Fig. 2 is a view of the rear part of the train, showing at the right two cars standing almost at right angles to one another. Fig. 3 shows one of the mail cars tilted over on its side, and having the front end of the locomotive underneath. The gas reservoirs are shown to be but slightly out of place, and though they bear marks of the battering to which they were subjected, they were not broken. In Fig. 4 are seen the side and roof of a mail car which has been struck and smashed by the end of another car.

The results of the accident bear testimony as to the important safety from fire which has been secured in recent years by the substitution of steam heat for "the deadly car stove" and the Pintsch light in place of oil lamps for car lighting A postal car has to be brilliantly lighted, and with the number of large oil lamps required to efficiently light such cars it very frequently happens in the wreck of such cars that the oil from the overturned and broken lamps becomes ignited and sets fire to the wreck.

In this accident, however, no fire was started in the wrecked cars, though all the cars were lighted. According to a statement furnished to us by a correspondent who visited the wreck, the first car (in going over the engine) was stripped of all its attachments under the body of the car, including the gas tanks. The second car was much in the same shape, although one or two battered and badly injured tanks appear to have remained on it. The third and fourth mail cars had their tanks on, but containing no gas, showing that it had leaked out of the tanks through broken connections. The first sleeping car, which was turned over on its side, had four atmospheres of gas when our correspondent looked at it, and the conductor stated that one jet had continued to burn all night. The apparatus on the last two sleeping cars did not appear to have been injured, except for a few broken globes, one car having seven atmospheres and the other an even greater pressure of gas in the tanks.

STEEL TIES ON THE NORMANTON & CROYDON RAILWAY, QUEENSLAND.*

The Normanton & Croydon Railway, in the northern part of Queensland, is 94 miles long, and is laid entirely with metal ties, and the track is described by Mr. J. A. Griffiths in a paper recently published in the Proceedings of the Institution of Civil Engineers, from which we take the following particulars: The track has a gage of 3 ft. 6 ins., laid with T-rails weighing 41¼ lbs. per yd., and on the first 36 miles the ties were 5 ft. 9 ins. deep, about 8 ins. wide, and 5 ft. 9 ins. long, weighing 84 lbs. The metal has a uniform thickness of 3-16 in., but at each rail seat there are two 3-16-in. plates (one inside and one outside the tie), secured by two rivets and a bolt. The rivets also hold the fixed clamp, which embraces the outer edge of the rail base, and the bolt holds the loose clamp, which secures the inner edge of the rail base. Wooden ties are used at turnouts, but on the curves the steel ties are used, the radius being such that no widening of the gage is necessary. The steel plates were shipped flat from England, and were afterwards pressed cold to the desired trough section, only about 12 plates out of 80,605 failing in this process. The completed ties were dipped in a bath of tar and Trinidad bitumen, kept at boiling temperature. Owing to the cost of freight from England to Brisbane and Brisbane to Normanton, with consequent rehandling, etc., the cost was high, averaging $2.22 per tie delivered at Normanton. On the remainder of the line the ties were 6 ft. long and weighed 100 lbs. each, but instead of the four extra plates, the tie was rolled so that the top was ⅜ in thick. These ties were made in Scotland and were pressed to shape at the works while hot. They cost about $2.40 each, delivered at Normanton. The cost of manufacture was about $1.26 and $1.36 for the light and heavy ties, respectively.

The subgrade was cleared and grubbed, and for a width of 8 ft. it was plowed to a depth of 6 or 8 ins. in heavy loam soil, or merely loosened by scarifying in light, sandy loam. The surface was then rolled by a three-ton roller 6 ft. long and 3 ft. diameter. The construction train sent out daily to the head of the line consisted of three long cars of rails, five or six short cars with ties and fastenings, and one or more water tanks. The material was unloaded and stacked at the end of the completed line. In tracklaying, a hand-car was loaded with four pair of 26-ft. rails, and 44 ties, the latter supported upon wooden sidebars. The car was drawn by a horse onto the last pair of rails laid, and six men working in pairs lifted off 11 ties and spaced them on the grade. The two rails were then laid and loosely spliced at the heel joint, and the car was then run ahead. Behind the car were about eight men bolting up the fastenings and joints. When the car was unloaded it was lifted off the track to make way for another loaded car. About half a mile from the head of the track was the surfacing and lining gang of about 25 men, who raised the track by screw-jacks (two jacks to each rail length), and shoveled the natural soil into and around the ties, and tamped it firmly into the ties by wooden rammers. In some cases the work proceeded at the rate of half a mile a day, but the average (excluding delays by floods, etc.) was from 2,112 to 3,432 ft. per day. Owing to delays in getting the ties from England, 13 miles of track were laid with sawed ironbark and half-round bloodwood ties. The cost of tracklaying with steel ties was about $356 per mile (or $293 at the more rapid rate), while with wooden ties it was nearly 50% greater. The total cost of surveying and constructing the line averaged $10,810 per mile, with $3,000 more for stations, rolling stock, etc.

As the railway connects a mining town with a port and runs through an uninhabited country, economy in first cost was an important consideration. The traffic averages three trains each way per week, with a few extra suburban trains. The engines have six wheels, all coupled, weigh 45 tons (including tender) and can haul 250 tons on the level, or 150 tons on the 2% grades near Croydon. After protracted rains, water flows across the line in broad sheets several feet deep and with fair velocity, so that any embankment, or even ballasting, above the normal surface would have required provision for waterways. The ties are, therefore, bedded in the soil, the rails offering the only resistance to the flood water. Trains are run when the line is under water, and the track bears the loads safely even when the soil is so wet that it is mere running mud to a depth of 12 or 20 ins., and cannot be crossed by men or animals. After the floods a little hard packing is tamped into the ends of the ties to replace that pumped out by the working of the ties. The cost of maintenance has diminished to about $310 per mile per annum, or about half that estimated for a track with wooden ties. There has been some slight corrosion of the ties where the track crosses a salt swamp, but, on the other hand, the wooden ties have been attacked by white ants, and 130 were renewed after a life of only three years. The work was designed and executed under the direction of Mr. George Phillips; Mr. Griffiths was Principal Assistant Engineer, and Mr. A. S. Frew, Resident Engineer.

* Further particulars of this railway and its track may be found in our issue of March 30, 1889, and in two reports on "Metal Ties for Railway Track," by E. E. Russell Tratman, issued by the U. S. Department of Agriculture, Washington, D. C., in 1890 and 1895.

THE CANADIAN PACIFIC RAILWAY, AS SEEN BY AN ENGINEER.

By Thos. C. Clarke, M. Am. Soc. C. E.

During a recent trip from Montreal to Vancouver and return over this famous road, a 6,000-mile journey, the writer made some notes which may be of interest.

The Canadian Pacific, as originally projected, ran from Callander, on Lake Nipissing, to the Pacific Ocean at Vancouver, a distance of 2,562 miles. Besides carrying out this original project, the company has added by construction, lease and purchase, lines from Callander eastward to the Atlantic Ocean at St. Johns, N. B., making the total length of its transcontinental line from ocean to ocean, 3,387 miles. It has also added, in the same manner, a great network of branch lines in all parts of Canada, also in Maine, North Dakota, Minnesota and Wisconsin, making the total mileage in the system, owned or controlled, 8,930 miles. The C. P. Ry. is thus the longest railway system in North America, except the Pennsylvania and the Atchison, Topeka & Sante Fe railways.

When work on this railway was begun, the country lying between the Ottawa River and the Pacific coast, a territory 2,588 miles in width, was either a wilderness or very sparsely settled. The city of Winnipeg, now containing 36,000 inhabitants, was just begun; the city of Victoria then contained about 5,000 people, and now has 20,000. No other towns were in existence, and, in fact, there were no white men in the region, except at a few scattered Hudson Bay ports, and in a few mining camps in British Columbia.

The Dominion of Canada first undertook to build the line, and did build through the canyon of the Fraser River in British Columbia, and from the head of Lake Superior to Winnipeg, in all about 650 miles. When it was decided that, to ensure rapid completion, the work must be turned over to private capital, the Government made a free gift to the Canadian Pacific Railway Company of the lines already built, which were in a very imperfect condition; they also gave a subsidy of 25,000,000 acres of wild lands, and $25,000,000. The C. P. Ry. Co. was given ten years to complete the gap between Ft. William and the Ottawa, and between Winnipeg and the head of the Fraser River canyon, a distance of about 2,100 miles. Instead of taking ten years for the work, however, the line was opened for traffic from Vancouver to Montreal in five years from the signing of the contract and 4½ years from the commencement of work in the spring of 1881.

From Winnipeg to Calgary, on the eastern slope of the Rockies, the line ran through prairie country for 840 miles, requiring but little grading. Here eight miles of track were sometimes laid in one day, bringing all the material forward.*

Grading through this part of the line was heavier than ordinary prairie work, averaging 17,000 yds. per mile.

The line along the north shore of Lake Superior, and through the Rockies, contained much heavy rock-cutting, and crossed many deep bogs, called "muskegs." The length of this heavy work was over 1,000 miles. The difficulty of getting in supplies was in many cases greater than that of building the road. Forty-six thousand men were employed on construction and in operating the lines as fast as they could be got ready.

The line had been located by the Government engineers to pass north of the great bend of the Columbia River, lat. 53°. A pass through the mountains where no white man had ever trod was found by a Canadian Pacific engineer, which shortened the length of the line considerably, and gave it its fine mountain scenery.

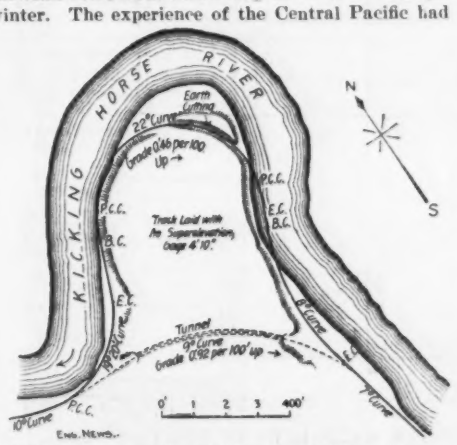
Major Rogers, the engineer who discovered this pass, was a capable man, but very eccentric in his habits. He would start off by himself prospecting and be gone for days, with no equipment save a chunk of pork and many plugs of tobacco.

When he had completed his work, the directors of the C. P. Ry. voted him $5,000 as a mark of their high appreciation. A check for the amount was duly sent, but, to the surprise of the accounting officers, it was not presented for payment. At last Major Rogers came to Montreal, and on being asked why he did not draw his money, exclaimed: "Great God, sir, that is the only testimonial I have. I have had it framed and glazed, and it hangs over my bed, and I will never part with it."

President Van Horne then ordered a gold watch to be engraved with an inscription fitly expressing the high esteem in which the Major was held, and the next time he came in showed it to him, and then locked it up in his drawer. The Major's delight was turned to astonishment, and he dubiously inquired if he were not to have the watch after all. "Certainly," replied Van Horne, "when ever you present that check and draw the money."

This is probably the only instance on record of its being necessary to give an engineer a douceur to make him accept that which was lawfully his own, and which was equally creditable to giver and receiver.

In constructing the Canadian Pacific Ry., the greatest difficulties to be overcome were found in the Selkirk range of the Rocky Mountains. The moisture-laden winds from the Pacific precipitate a snowfall sometimes amounting to 40 ft. in a single winter. The experience of the Central Pacific had



A 22° Curve on the Kicking Horse River, Mountain Division, Canadian Pacific Ry

shown that snow sheds protected the track from the snowfalls on that line, but on the Canadian Pacific the snows were heavier and much more dangerous. Avalanches fall from a height of 3,000 to 4,000 ft. above the track, not only cutting down every tree in their path, but by the force of the side currents of air, breaking off trees 2 ft. in diameter. They sometimes fill up the whole ravine below the track from 700 to 800 ft. in depth.

The snow sheds, of which there are about 6½ miles, are simply wooden tunnels built against the face of the side cuttings in the rock. They are made of bents of 12×12-in. cedar placed about 4 ft. apart, and planked longitudinally. On the land side they are made of cedar cribwork filled with stone. Their roof is made sloping, so that avalanches glance over without injuring them.* Luckily the avalanches always fall in the same place, and when protecting works make this secure all danger is averted. Sometimes diversion cribworks have been built on the mountain slopes, which divert the avalanches into another valley. This simple plan of avoiding, instead of trying to resist the forces of nature, has worked so well that traffic has never been delayed during any winter.

There is an engineering curiosity on the west slope of the Rockies in the shape of a 22° curve, which is illustrated here. It was laid as a temporary expedient to avoid a tunnel through running clay, that would have required expensive lining, but it has worked so well that it remains, and the tunnel has never been finished.

When this sharp curve was laid the outer rail was elevated 6 or 7 ins. above the inner, but much grinding took place. Finally both inner and outer rails were laid on the same level. In running down the train moved around this curve at a rate of at least 25 miles per hour, and I could detect no difference in sound or motion from any other part of the line.

The building of the road in such a short time was the financial salvation of the whole enterprise. During the first five years after the road was opened, it earned nearly $77,000,000. Had ten years been taken for construction, instead of less than five, the interest charges during the last five years would have amounted to $30,000,000.

To facilitate the early opening of the road, it was necessary to put in wooden trestle work where the cuttings did not furnish sufficient material. On the line between Montreal and Vancouver, 2,906 miles, there were a great number—nearly 2,000—of these construction trestles. There are now less than 200, of which over half a dozen are large ones. The rest have been replaced by stone culverts and embankments or by steel bridges on stone piers.*

Deck spans are used wherever possible, and where through spans are unavoidable they are made 20 ft. wide between centers, to prevent being struck by derailed trains. The ties are placed 4 ins. apart, and double guard timbers are used—one on the outer end of the ties and one near the rail. The inner ones curve out at the ends, and are united with the outer ones by iron plates.

At some points where high embankments have been made at bridge approaches, the end spans of the bridge rest on piles, instead of masonry abutments. The idea is that by the time the piles decay the bank will have thoroughly settled, so that a masonry abutment can be built which will be more secure than if it had been constructed when the bank was first made.

A fine steel arch, of 336 ft. span, has been built in the place of a trestle across a ravine about 300 ft. deep, at a place called Stony Creek.** The cost of this arch, with the foundation and approaches, was $96,000.

We saw, at the crossing of the Fraser River, the grandmother of all modern cantilever bridges, designed by C. C. Schneider, M. Am. Soc. C. E. It is a fine bridge, and closely resembles its fair daughter at Niagara Falls.

In two cases embankments, one of 66,000 cu. yds., and one of 144,000 cu. yds., have been filled with gravel, by hydraulic power, conveying the gravel from a hill about 200 ft. away. The cost of this work was 7.15 cts. per yd.

Many retaining walls have been built along the Fraser and other rivers, of concrete made of stone and sand taken from places near by, and of Portland cement, made at the railway company's own works. Their cost has averaged $5 per cu. yd. Some of them are 100 ft. high.

Where stone is scarce, cedar culverts have been used under embankments not over 20 or 25 ft. high. The West Coast cedar is one of the most durable of all timbers. A cedar log is to be seen in the park at Vancouver lying upon the ground. Over this grows another cedar, at least 168 years old, judging from its size and number of rings, and pinning down the log with its roots. No signs of decay are perceptible in the fallen log. Mr. P. A. Peterson, Chief Engineer of the C. P. Ry., has sent a cutting from it to the American Society of Civil Engineers, in whose rooms it may be seen.

The track is in excellent order. The ties are large, and spaced about 2,700 per mile. In the Rocky Mountain section the ties are 9 ft. long, elsewhere 8 ft. The rails weigh 50 to 72 lbs. per yd. The road is all well ballasted. The heavier rails are united by angle bars, 44 ins. long, with six bolts. The long splice is preferred.***

The grades are generally not over 52 ft. per mile, except on the western slopes of the Rockies. Here there is at one place a grade of 234 ft. for four miles, limiting the number of cars in freight trains to 12, with a pushing engine in the rear. There are other grades of 116 ft. per mile, but all embraced in a radius of 120 miles on the west slopes of the Rockies and Selkirks.

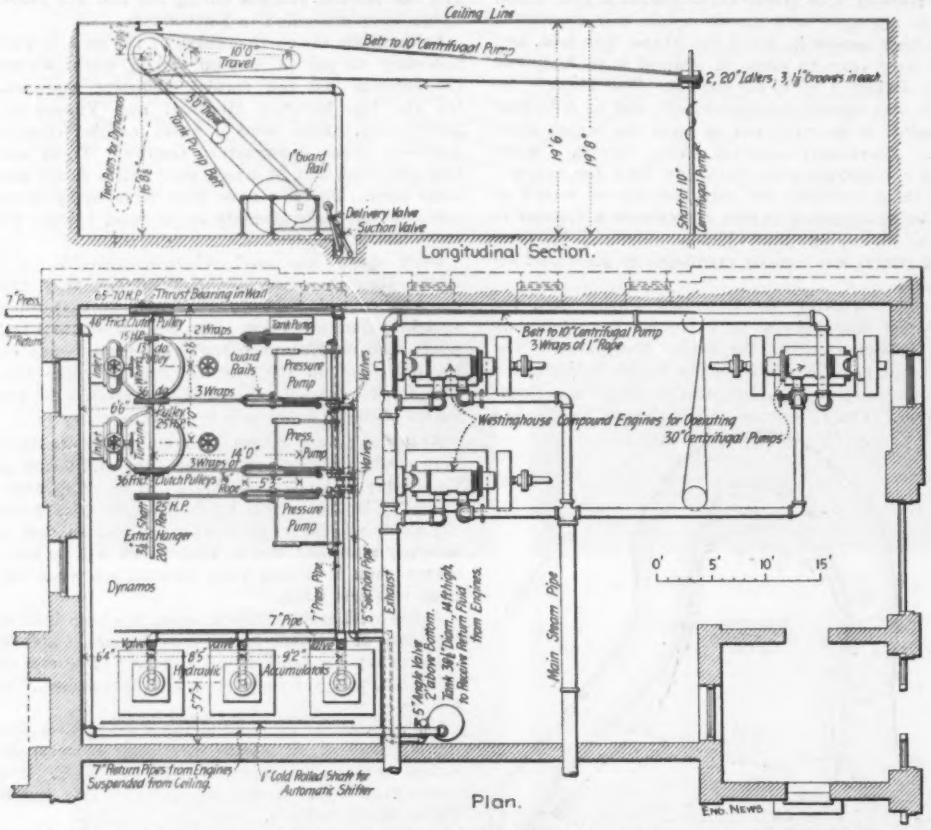
* Illustrated in Engineering News, Nov. 14, 1895.

* These snow sheds were illustrated and described in Engineering News of Oct. 8, 1887.

* This work is described in another column.

** Engineering News, Aug. 2, 1894.

*** Eng. News Jan. 19, 1893; Nov. 8, 1894, and Nov. 7, 1895.



GENERAL ARRANGEMENT OF HYDRAULIC POWER MACHINERY IN POWER HOUSE.

to view structures, and at night, it was necessary to run fast while in motion. The train frequently ran 50 miles an hour, with no unpleasant motion, and could have passed Frank Blair's famous test on the Union Pacific—that the observation car should not spill a full glass of whisky and water on straight lines at high speed.

The mails were once carried from Vancouver to New York in 85 hours, and from Yokohama to London in 20½ days. A speed can be made on the greater part of this line equal to that on the New York Central or Lake Shore railways.

American investors have sometimes expressed surprise that a railway running through a partially-developed country should be able to meet its fixed charges, and even pay dividends on its stock. Some of the reasons are as follows: The fixed charges, including interest, leases, etc., are very light, the sum per mile of track operated not exceeding two-thirds the average figure for United States railways, as given in "Poor's Manual." The mortgage of the main line, which has to be taken care of in bad years as well as good, is only $35,000,000, the interest on which is $1,750,000.

All the "side shows," such as town sites, sleeping and dining cars, lake and ocean steamers, hotels, telegraph, express, grain elevators, etc., are the property of the company, and their earnings contribute to its revenue. During prosperous years the profits pay the whole interest on the $35,000,000 general mortgage bonds of the company. As a matter of prudent management, the total receipts of the company are paid daily into the Bank of Montreal, which deducts from each payment a sum sufficient to pay the fixed charges for that day, and the balance only is given to the Treasurer of the company to pay expenses, and, if anything is left over, dividends on stocks.

This company, instead of a floating debt, has long had a surplus of $7,000,000 to $8,000,000 in its treasury. During the hard times of 1893-5 this surplus was reduced to $2,739,792, but with the revival of business it will be increased again.

In the management of its 20,000 employees, civil service principles prevail. Each employee knows that his own place belongs to him during good behavior, and that when the place above him becomes vacant, it is also his, if he can fill it.

Everybody knows that the management of a railway to be successful must be autocratic. This is the case with the Canadian Pacific. Its success is due, in a large measure, to the skill and ability of its President, Sir William Van Horne, who built the road, developed its traffic, and now manages it. In specially mentioning his name, I know that he is but the general of an army. But it is an army which he personally has selected, drilled and disciplined, and which he maneuvers with rare executive ability.

Did space allow, the writer would like to express his admiration of the grand and picturesque scenery through which this line passes, on the north shore of Lake Superior and the Rocky Mountains.

The latter recalls the high Alps of Switzerland, except that we are much nearer to the mountains, which rise in sheer heights of 7,000 to 8,000 ft. above our heads.

The contrast between the snow and ice above and the station gardens, blooming in late October with roses, pansies, chrysanthemums and other bright flowers, is very striking. The writer wishes that the American Society of Civil Engineers might hold an annual convention on the Pacific coast and go over this line.

THE NEW UNITED STATES GOVERNMENT LOCK AT SAULT STE. MARIE, MICH.

V.

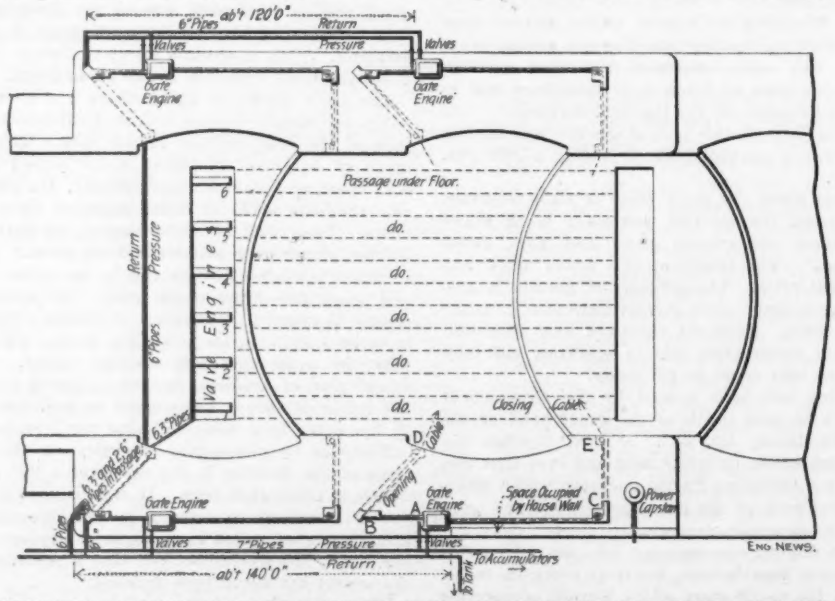
Gate Operating Machinery.

(With Inset.)

Full details of the machinery for operating the gates and valves are shown in the accompanying cuts and on our inset sheet this week.

Water-pressure engines are used for operating both the lock gates and the large butterfly valves closing the filling and emptying culverts. Briefly described, the water from the upper level at the west end of the lock is conveyed by a 6-ft. supply pipe to two horizontal turbines placed in a wheel pit in the power house at the east end of the lock. These turbines operate three pressure pumps, which pump into three hydraulic accumulators. From the accumulators the water is piped to the water-pressure engines operating the gates and valves. The several plans show very clearly the arrangement of the shafting and belting for operating the machinery in the power house, the location of the valve and gate engines and the arrangement of the water-pressure pipes supplying the power. Care has been taken to label the various machines and their connections on these drawings and their operation and relation need not be described further. The location of the engines and pipes at the east end of the lock only is shown here, but the arrangement at the west end is practically the same.

Pumps and Accumulators.—There are three three-plunger pressure pumps of the design shown on the inset sheet for compressing the water and supplying it to the accumulator. Each of these pumps is operated from a main shaft driven by rope belting from the horizontal shaft operated by the turbines. This main shaft operates the engine shaft by spur gearing. The drawings show clearly the construction of the pumps. The safety



SKETCH PLAN SHOWING LOCATION OF HYDRAULIC VALVE AND GATE ENGINES AND WATER PRESSURE SUPPLY PIPES FROM POWER HOUSE.

valve and by-pass, shown in detail, are, of course, made adjustable to the pressure to be carried on the mains. The pressure of the water delivered by these pumps is regulated by, and any excess of pressure stored in, three accumulators 18 ins. in diameter and 98 ins. stroke of plunger. A vertical section of one of these accumulators is

shown by the drawings. The plunger is of cast iron and the cylinders of welded steel. Each accumulator is fitted with connections for throwing out the driving clutches of the pumps when the accumulator cylinder is full, and starting the pumps again when water is needed.

Valve and Gate Engines.—The water-pressure engines for operating the valves are horizontal, direct-acting engines, with 8-in. cylinders and 48-in. stroke of piston. The drawing shows one of these engines attached to the valve. As will be seen the crosshead is guided below the pin and connected directly to the crank-pin of the valve by a connecting rod of ordinary pattern. The pressure pipes are so arranged that the engines, and therefore the valves, operate in pairs. The operating valve for each pair is placed on the lock wall. The stroke of the piston is limited by a dashpot at each end.

There are six gate engines, one for each leaf of the upper and lower lock gates and the intermediate gate. A plan and elevation of one of these engines are shown on the inset sheet, as is also their location on the lock wall. Each machine consists of two three-cylinder engines, operating 24-in. pinions keyed to the engine shafts. These pinions mesh with a 6-ft. gear on the main shaft. The drum is spirally grooved, and is provided with an internal gear, through which it is driven by planet wheels. The speed of the drum is controlled by a friction brake, as shown in the drawings.

The method of operation in opening and closing the gate leaves can be seen from the drawings. Take, for example, the engine located at A. The rope passes around the drum; one end goes east to the inclined sheave C, thence down through the inclined culvert to the sheave E, and thence to a connection with the concave side of the leaf at the miter post; the other end goes west to the sheave B, thence through the culvert to D, and thence to the miter post at the convex side of the gate leaf. By turning the drum in one direction, the leaf is opened, and by turning it in the opposite direction the leaf is closed. The cables are of steel, with hemp core, and are 1 in. in diameter. They were required to show under test a tensile strength of 100,000 lbs.

The guard gates are to be operated by power capstans run by three single-acting 7 × 12-in. oscillating cylinders. The location of the capstans is shown in Fig. 2. All the hydraulic machinery was designed by Mr. Frank M. Dunlap, under the direction of the late Col. O. M. Poe, U. S. Engineer Corps.

THE TRANSVERSE STRENGTH OF CAST IRON AND ITS SHRINKAGE IN COOLING.

Some interesting experiments, made to determine the transverse strength of cast iron and also to illustrate the molecular changes which that metal undergoes in cooling from a liquid state, were described by Mr. W. J. Keep, M. Am. Soc. M. E., at the last meeting of the American Society of Mechanical Engineers at Detroit. These tests were made in connection with the work of the Committee of the Society on Standard Tests and Methods of Testing Materials, but were contributed as independent papers by Mr. Keep, and not as a part of the report of the committee. The main features brought out by these experiments are abstracted herewith:

Transverse Strength of Cast Iron.

Altogether, 19 series of tests were made, each series consisting of nine tests of ½ × 12-in., 3-in. and 4-in. square bars, and a 1 × 2 in. × 2-ft. bar. Series 1 to 12 and series 14 also contained two tests each of 1-ft., 4-ft. and 4½-ft. 1-in. square bars and two tests each of 1 × 2 in. × 1-ft. bars. The bars in Series 1 to 6, inclusive, were made of "Iroquois" coke pig iron from Lake Superior ores; in Series 7 to 12, inclusive, of "Hinkle" charcoal pig from Lake Superior ore; in Series 13 to 15, inclusive, of "De Bardeleben" coke pig from Southern red fossil ore; in Series 16 to 19, inclusive, of the regular mixtures from four different foundries. These several series had their silicon varied by additions of high silicon, or silvery iron, so that the average silicon, by analysis, was for each in order as follows: Nos. 1 to 6, 0.81%, 1.20%, 1.88%, 2.01%, 3.19%, and 3.04%; Nos. 7 to 12, 0.93%, 1.17%, 1.67%, 2.23%, 2.71%, and 3.05%; Nos. 14, 13, 15, 2.18%, 3.18%, and 3.51%.

The iron for each of the 19 series of test bars was melted in a cupola with coke, and the molding was like that of ordinary castings, surrounded by the conditions which are certain to surround all foundry operations. All the bars for an entire series were cast from one mixture, melted and drawn from the cupola at once, and poured at the same time into molds which were of uniform composition. For this reason the larger the casting, the more slowly the metal cooled. Each increase in size represents a slower rate in cooling, which caused the grain to be more coarse and loosely put together in the larger castings.

Figs. 1 and 2 show graphically the results obtained from the tests with the records of all the larger bars reduced to the dimension of a ½-in. bar, 12 ins. long, to enable direct comparison. The cause of much of the irregularity shown in these diagrams is the varying conditions which surround all foundry operations. Practical iron founding cannot be separated from such influences, which produce variations in each casting. Fig. 3 is an ideal chart in which the influences which caused the variations in the record of the different sizes of bars have been eliminated, every condition being made uniform.

The following are Mr. Keep's conclusions in regard to what the tests show:

1. The strength increases in the ½-in. bars with each increase of silicon up to as high as 3.50%. The castings are also softer with each increase of silicon. This corresponds with foundry experience.

2. The strength decreases as castings increase in size, when both large and small castings are made from the same iron. Decrease in strength is more rapid in castings between the sizes of ½ in. and 1 in. than between larger sizes.

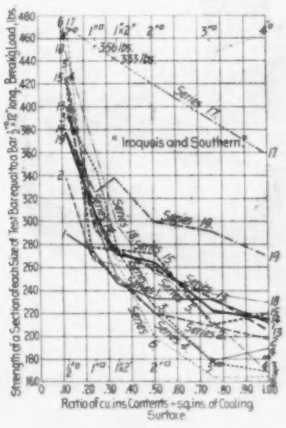


Fig. 1.

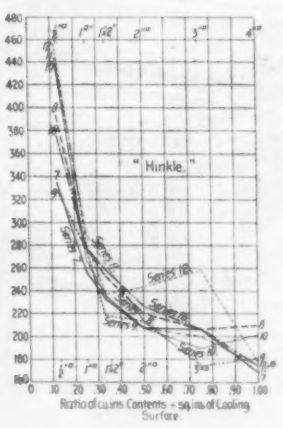


Fig. 2.

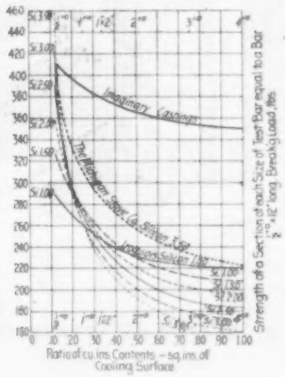


Fig. 3.

Figs. 1 and 2.—Diagrams Showing Results of Transverse Tests of Cast Iron Bars of Different Sections and Lengths All Reduced to Size of Smallest Bar, ½ × ½ × 12 ins.

(Ordinates Show Strength and Abscissas Cubic Inches Contents Divided by Square Inches of Cooling Surface.)

Fig. 3.—Diagram Showing Approximate Relation of Strength of Cast Iron Bars to Size and Percentage of Silicon. All Sizes Being Reduced to Area of ½-in. Square Bar.

3. The decrease in strength is greater and more rapid with each increase of silicon. In each of the charts the curve representing the strength due to the lowest percentage of silicon begins lowest on the ordinate of the ½-in. test bar, but owing to the decrease of strength due to each increase in size of test bar the curve ends on the ordinate of the 4-in. bar at a point much lower than that at which it began.

The curve representing the strength due to the highest percentage of silicon begins at the highest point on the ordinate of the ½-in. bar, and because the increase of silicon causes a more rapid decrease of strength in the larger bars, the curve drops much more rapidly than the low silicon curve. This causes the distance between the curves to diminish as the size of the bars grows larger.

That increase of silicon weakens large castings is in accord with shop experience and with general opinion. The fact that a small casting grows stronger with each increase of silicon (at least up to 3%) does not seem to have been noticed, probably because test bars of 1 sq. in. area have been used. It is the experience of makers of castings thicker than 1 in. that any increase of silicon softens the casting, but at the expense of strength. For large castings, therefore, it has been the practice to use the least silicon that would produce the requisite softness. It is because of variations in conditions, that cannot be avoided by the founder, that in cast iron we must allow a very large factor of safety.

4. The record of one size of test bar cannot indicate the strength of another size, for the reason that, with the same iron, aside from the local causes of derangement, any change in size—or, in other words, any change in the rate of cooling—will change the grain and strength. Each mixture of iron, and each percentage of each percentage of silicon. But as each curve crosses each of the others, there will be a size of casting which will show the same strength in both a high and a low silicon iron, and a test bar of this size would give no indication as to the difference in the metal in these irons, but the results of such a test bar would be absolutely uniform. While the 1-in. test bar gives results nearer together than any other size, yet for light or heavy machinery irons it does not give intelligible results.

The strongest iron is that which contains the amount of silicon necessary to remove brittleness in the individual size of casting, and to produce the closest possible grain. To produce the strongest castings resolves itself into methods for producing a close grain free from brittleness, (1) by using a low silicon iron for large castings, and (2) by using a higher silicon iron, which naturally has a close grain.

The first method, using low silicon pig iron, is in most common use, and the latter method requires the knowledge that a closing of the grain produces strength, and also that a pig iron with a close grain will make a close-grained casting. If the founder has learned this, he is on the right track. When the principle of keeping the grain uniform and close and the iron soft has been learned, pig iron from almost any furnace can be found with a suitable grain. The mixture that produces the strongest ½-in. bar with the closest grain will also show greatest strength in a 4-in. casting, if the grain is kept close. Powdered ferro-manganese is often thrown into a ladle to cause a fine granular structure. Wrought iron borings or chips put in the cupola along with the pig iron will also cause the grain to be close. A rod of wrought iron is sometimes held in the spout of the cupola, so that the end may melt off and mix with the metal. An old file is

of silicon, will produce the best results in some one single size of casting, and not as good a result in any other size.

5. The term "cast iron" does not indicate a definite composition, whose strength in a test bar, broken transversely, varies directly as the square of the height, as the breadth and inversely as the length. The metal is strong according as its grain is close and fine, and this is governed by the percentage of silicon and by the rate of cooling, and by local conditions over which the founder has no control. Therefore, the test records of most investigators are of little value, because they were not aware that a large casting, cut down to another size, was weaker than if cast to size, and they were not aware that a variation in silicon would strengthen a small casting and weaken a large one. Their work would be comparable with other tests if all had recorded the percentage of silicon, or the shrinkage, which would give an idea of the amount of silicon, and if they had stated whether the casting was cast the size at which it was tested, or what size it was before it was cut down to the required size. In the latter case, however, the test would be of little value, as no casting has the same grain all the way through. The character of the original irons, also, or the heat of the cupola at the time the iron was melted, may change the strength, outside of the influence of silicon or the rate of cooling.

Some have conceived that the size of test bar which would give the most uniform results for all cast iron mixtures would be the best size for a standard. The idea would be to have the least difference between the highest and the lowest record, and the greatest uniformity in results. An examination of Figs. 1 and 2 shows at a glance that the 1-in. bar best fills these requirements. This size shows very nearly the same record

sometimes melted in a ladle for the same purpose. Cast iron chips or turnings are sometimes placed in wooden boxes, with the covers nailed on, and charged along with the pig iron, to cause an even and close granular structure in the casting. The most profitable line for experiment is to find cheap practical methods for closing the grain. The grains should be of uniform sizes and of the smallest possible dimensions.

If the grain could be closed still more, we should finally obtain the result marked "imaginary casting" in Fig. 3; and if the nature of the metal could be so changed that slow cooling would not open the grain at all, but leave it the same as in the ½-in. bar, the diagram would be a horizontal line, and then, and only then, strength would vary as the square of the height, and as the breadth, and inversely as the length, which would be perfection, but which can never be reached in foundry practice.

Regarding what the experiments show respecting the strength of cast iron as influenced by chemical composition, it will be seen that silicon is the controlling element, and its influence has already been explained.

It is the universal opinion that strength is mainly due to the combined carbon which the casting contains, and that weakness is caused by changing it into graphite, which mechanically separates the grains. Combined carbon weakens cast iron. In each of the charts we see that in the ½-in. bars, with each increase in silicon, the combined carbon is decreased, and that the strength is increased in the same proportion. In the ½-in. test bars of each series, containing about 1% of silicon, the combined carbon was about 1.50%, and the iron was weak because it was brittle. As combined carbon decreased in the ½-in. bars with each addition of silicon, the brittleness decreased. This is shown strikingly in Series 14, 13 and 15. The ½-in. bars show the natural strength of the iron.

Combined carbon may decrease as castings are larger, but the strength always decreases. This decrease of combined carbon and of strength are both caused by the slow cooling, and the decrease of combined carbon has nothing to do with the decrease of strength.

The general opinion is that graphitic carbon causes weakness. The carbon in a casting, so far as has been proved, is either combined or graphitic. If one decreases, the other must increase. Therefore, if combined carbon produced strength, the same facts that seemed to warrant this conclusion of the chemists seemed to prove that graphitic carbon produced weakness. Again, in graphitic iron, the grain was coarse, and the flakes of graphite lay between the grains, and it seemed self-evident that these graphitic flakes must of necessity separate the grains of iron and cut the casting up. From an examination of these series, strength or weakness seems to be absolutely independent of this element. The looseness of the grain, produced by slow cooling, so separates the grains that there seems to be more than enough room for the flakes of graphite to lie in the open spaces. It may be even doubted if the graphite ever gets between the grains to make their union less perfect. The graphitic scales seem to have formed in the spaces after the openings have been formed, and either act as a cushion, or the scales lie loosely in the cavities. This latter supposition seems plausible, from the fact that when pig iron, or a casting as large as a pig of iron, is broken, scales of graphite fall out in great abundance.

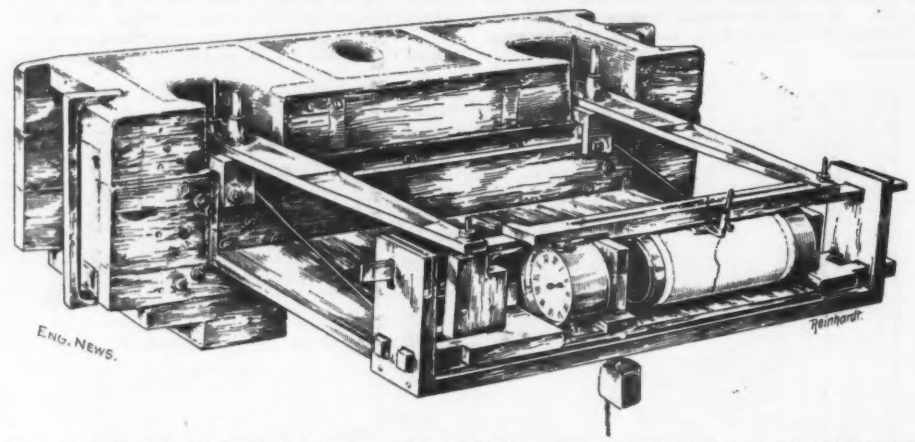


FIG. 4. SKETCH OF APPARATUS FOR RECORDING AUTOGRAPHIC COOLING CURVES FOR CAST IRON.

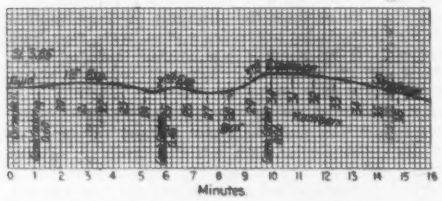


Fig. 5. Typical Cooling Curve of Cast Iron Bars.

Regarding the bearing of total carbon on the question of strength, the series described in this paper do not present enough data to form any conclusions.

These 19 series bring out many interesting facts regarding sulphur. The universal opinion seems to be that sulphur is a damage to cast iron; but we can find nothing to show a ground for the origin of the opinion that prevails. Sulphur is not by any means uniform in the 19 series, but there is not the least indication of evil result from its presence in the series containing the highest sulphur.

Molecular Changes in Metals Due to Varying Temperature.

As metals shrink in proportion as they lose heat, the autographic record of such simple shrinkage should be a curve showing these proportions. Autographic records of cast iron during its cooling from a molten to a cold temperature show peculiar uniform irregularities in the curve before the shrinkage due to decreasing temperature alone takes place. This irregularity of the first part of the curve is caused by a rearrangement of the crystals, and is purely a physical process.

Fig. 4 is a sketch of the apparatus used for making the autographic records of the expansions and contractions of cast iron when cooling. A mold is made for a 1 × 1 in. × 26-in. test bar. In the front of the flask recesses are cut to allow the ends of this mold to be reached. The top of each end of the mold is covered with a piece of tin, having a ¼-in. round hole in it, the two holes being 24½ ins. apart. Through these holes are passed ¼-in. steel pins. It will be seen that when the mold is filled, the molten metal surrounds the pins, and any expansion or contraction of the bar pushes the pins apart, or draws them nearer together, as the case may be. A lever having a ¼-in. hole in its shorter arm is attached to each pin. These levers are pivoted at the edge of the flask, and the outer ends multiply any motion of the test bar ends ten times. One arm moves a slide which carries a pencil, and the other arm moves a slide upon which is located a cylinder which carries the ruled record paper, and also carries a clock which revolves the cylinder one complete revolution per hour. As one arm moves the pencil, and the other moves in an opposite direction the slide which carries the cylinder and clock, the record is the sum of the motion of the two ends of the test bar.

The curves obtained with this apparatus varied in shape with the changes in the chemical and physical combination of the iron. Iron with silicon quite high made the most attractive curve, and this curve, Fig. 5, is therefore taken as an example. This curve shows that the casting remained fluid for one minute, during which time the ends of the bar remained stationary. When the whole of the test bar had become solid it expanded for 16 minutes. This expansion began 1½ minutes after the mold was filled, increased until 3½ minutes, and then decreased until seven minutes. This may be called the first expansion. The expansion then increased until eight minutes, and decreased again until ten minutes. This may be called the second expansion. A very great expansion then took place, rendering its maximum between 12½ and 14 minutes, and decreasing until 16 minutes, or a little later. This may be called the third expansion. When these expansions are completed, the regular shrinkage curve from the loss of heat is formed.

To get an explanation of Fig. 5, 18 test bars 1 in. square and 1 ft. long were poured at the same time as the 2-ft. test bar from which the diagram was taken. As the bars were made in a snap flask, there was nothing around the bar but sand. The first bar was numbered 19. At the end of one minute the iron in the gate was still fluid. At 1½ minutes the sand was cut away and the bar taken out, but it broke by its own weight, though it was not fluid. One half of this bar was dropped into a barrel of ice water, and the other half was allowed to cool in the air. At the end of each minute thereafter the sand was cut away from a bar which was broken, and half of it dropped into the ice water. From the fact that the cooling of a ½-in. bar in water cannot be instantaneous, and that anything short of that would allow a change in crystallization, the quenched bars give only a faint idea of the condition of the iron at the time it was taken from the mold.

Each bar was a little stronger than the preceding one, and as soon as it could not be broken with a pair of pincers alone, one-half of the bar was placed in a hole in a heavy block of iron, when a wrench of the pincers would break it. Then a light blow of a hammer, and toward the end quite a sharp blow from a five-pound hammer was needed.

The curve in Fig. 5 was then divided according to the times of breaking the 18 bars, to see which belonged to the different parts of the curve. Previous to making the bars described, and while another curve was being made, a similar number of bars numbered from 1 to 18 had been broken.

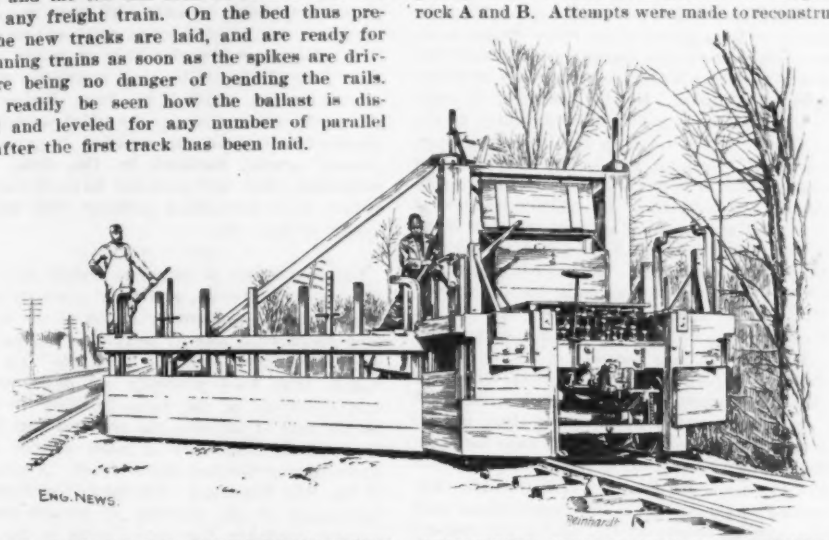
An examination of the fracture of these two series of quenched bars shows a great change in the crystalline structure before and after the third expansion, but these fractures do not at all show what the iron really was, because quenching cannot entirely prevent the crystals assuming their natural form. To get an approximate idea of the state of the iron, the bars numbered 19, 25 and 30 were selected for analysis; No. 19 before the iron was solid, No. 25 during the second expansion, and No. 30 just as the third expansion had reached its maximum. The combined carbon in bar No. 19 was 0.60%; in bar 25, 0.45%, and in bar No. 30 it was 0.06%. From the location of the curves, bars 26, 27 and 28 were probably as hard and contained as much combined carbon as No. 25. As bar No. 28 probably contained 0.40% combined carbon, and as bar No. 30 contained only 0.06% combined carbon, which is the same percentage as was contained by the portion of the bars which were allowed to cool in the air, it appears that the change of combined carbon into graphite takes place in less than one minute in a casting 1 in. square, cooled in its own mold, and that this is the time when hard iron changes to soft iron. After the third expansion no further change in the crystalline structure took place, and the shrinkage curve was that ordinarily made by the loss of heat. The bars Nos. 19 and 25 were so hard that they could not be touched with a drill, and it was very difficult to break off enough for analysis. It would seem that the bars were much harder than could be accounted for by the 0.60% of combined carbon, while bar No. 30 was very soft. The final arrangement of crystals took place during the third expansion, and at that time the iron became soft.

The remainder of the paper is devoted for the most part to a consideration of the different curves obtained in different tests, and which vary in form with variations in the chemical and physical compositions of the iron. As the paper draws no very definite conclusions in this discussion as to the effect of the proportions of the various elements entering into these different compositions, we do not give the discussion here. The main point brought out is that certain molecular changes, or rearrangements of the molecules, take place during the early part of the cooling of iron castings; that apparently these take place for any particular iron at definite temperatures, and that the change of combined carbon into graphite carbon occurs during the so-called third expansion. The experiments will be continued with the view of definitely establishing the full significance of the curves described.

BALLASTING FOR FOUR-TRACK WORK; NEW YORK, NEW HAVEN & HARTFORD R. R.

In building the additional tracks for the four-tracking of the New York, New Haven & Hartford R. R., between New York and New Haven, a temporary track of old material is first laid on the subgrade. The ballast is then hauled in and the temporary track raised by jacks to the proper grade. After this the old track is replaced by the material for the permanent track, which is thoroughly tamped, surfaced and lined. The ballast is of broken stone, carried on low, drop sideboard cars, each holding 10 cu. yds., and the unloading is done by hand. From this first new track the ballast for the two adjoining tracks is then unloaded, and is leveled off to the bottom of the ties by means of the leveler or spreader, shown in

the accompanying cut. This consists of a heavily-loaded flat car fitted with wings 20 ft. long, these wings having plate iron scrapers, which are adjusted by means of two ratchet jacks. When not in use the wings are folded against the side of the car, and the car can then be hauled over the road in any freight train. On the bed thus prepared the new tracks are laid, and are ready for slow-running trains as soon as the spikes are driven, there being no danger of bending the rails. It will readily be seen how the ballast is distributed and leveled for any number of parallel tracks after the first track has been laid.



BALLAST LEVELER ON FOUR-TRACK WORK; NEW YORK, NEW HAVEN & HARTFORD R. R.

In making large fills with gravel where the haul is short, flat cars are used, and are unloaded by a side or center plow hauled by a cable from the engine in the usual way. When the plow has been hauled the length of the train, the cable is unhooked and thrown to the side of the track, the front end being hitched to a small derrick, arranged like a mail crane. When the next gravel train comes up it runs slowly by, picking up the cable at the front car, while the derrick holds it in position until laid the full length of the train. The cable is thus handled by one man, while in ordinary practice it takes several men a considerable time to place the heavy steel cable on the gravel train. For the accompanying particulars of this work and the view of the ballast-spreader we are indebted to Mr. C. C. Elwell, Roadmaster of the New York Division, N. Y., N. H. & H. R. R.

RUBBLE CONCRETE WORK AT WRIGHT'S TUNNEL, SOUTHERN PACIFIC R. R.

An interesting example of rubble concrete construction is described by Mr. John D. Issac in a paper read before the Technical Society of the Pacific Coast, April 5, 1895, and published in the September issue of the "Journal of the Association of Engineering Societies." The work was constructed to stop a landslide which had occurred at Wright's Tunnel, at the summit of the Santa Cruz Mountains, on the narrow gage line of the Santa Clara Division of the Southern Pacific Co., in California.

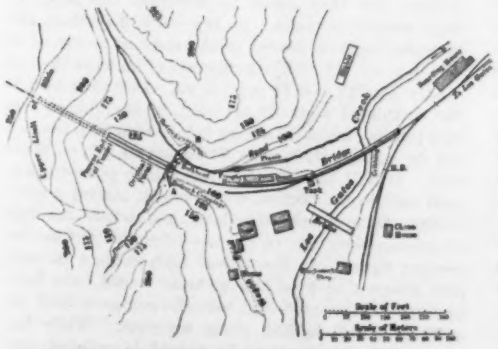


Fig. 1. Map showing location of Landslide and Retaining Wall at Wright's Tunnel.

At this place, as is shown by Fig. 1, a tributary of the Los Gatos Creek, which flows nearly due east, is joined by a side creek flowing north. These streams are nearly dry in summer, but become torrents in stormy weather, and during the heavy storms of 1892-3 they cut through their clay beds to the rock, and the whole hillside for some 300 ft. back slid toward the east. This slide crushed in about 200 ft. of the east end of the tunnel and completely filled the narrow throat between the points of rock A and B. Attempts were made to reconstruct the tunnel portal, but none were successful until when dry weather came, an open cut was made through the slide. This was a temporary expedient only, and it was realized that some more permanent work would have to be constructed, or else the slide would continue during the next wet season. After due consideration it was decided to build a concrete retaining wall, A and B, and also to reconstruct the injured part of the tunnel with concrete.

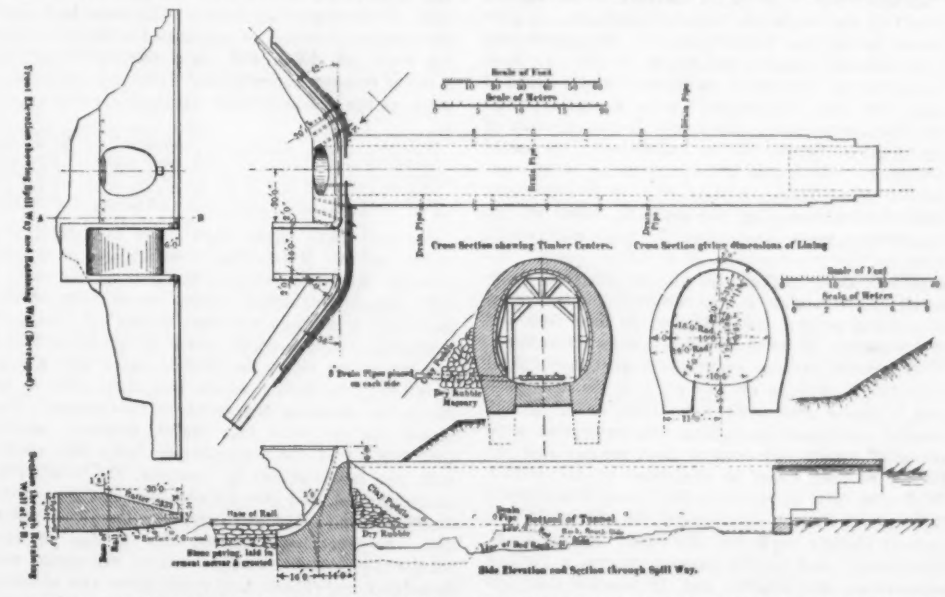

Scale of Feet
Scale of Meters
Cross Section showing Timber Centers.
Cross Section giving dimensions of Lining
Dry Rubble Masonry
Clay Puddle
Dry Rubble
Base of Rail
Stone paving, laid in cement mortar & grouted
Side Elevation and Section through Spill Way.

FIG. 2. DETAILS OF CONCRETE TUNNEL LINING AND RETAINING WALL AT WRIGHT'S TUNNEL.

Fig. 2 shows the details of this concrete work. It will be seen that the beds of the creeks were filled, re-establishing the toe of the slide, and the side creek from the south carried behind the wall over the top of the tunnel and made to join Los Gatos Creek just at a spillway in the west side of the wall, through which the combined streams now discharge. As it was desirable to avoid hydrostatic pressure on the wall, it was backed by dry rubble masonry, covered with clay puddle, and separate drains were run from the puddle and the slide behind it through the wall. As the tunnel cut through the slide, it had to be constructed so as to transmit the pressure from north to south. The sides of the barrel were therefore carried down to bedrock, and the key piece put in under the track as shown. The barrel was covered from 14 ft. to 42 ft. deep with earth, firmly tamped at the sides, making it in effect a part of the slide.

The concrete used consisted of 1 part Portland cement, 2 parts sand, 3 parts gravel, and 4 parts broken stone. All the portion of the concrete masonry below the base of the rail except the key piece is rubble concrete—i. e., it has imbedded in it large pieces of rock varying from ¼ cu. yd. to 1 cu. yd. in size. The method of construction was first to tamp a layer of concrete 6 ins. thick, and while yet soft to place upon it the rocks with their best bed down, leaving about 18 ins. clearance between them. Smaller stones were placed in the interstices, and then the remaining spaces filled with concrete, thoroughly rammed. A second 6-in. layer of concrete was then placed on top of the rubble, and then a second layer of rubble laid, this process continuing until the height of the base of the rail was reached. Above this point the same mixture of concrete was used, but the rubblestones were omitted. This work was nothing out of the ordinary, and is sufficiently described by the cuts. The cost of the concrete in place, without large stones, was $6 per cu. yd., exclusive of molds. The cost of the rubblestone in place in the concrete was 60 cts. per cu. yd. For every cubic yard of concrete replaced by a cubic yard of stone in the work there was, therefore, a saving of $5.40. No figures are given of the percentage of the total space which was occupied by rubblestone.

The Lee straight-pull magazine rifle now adopted for the U. S. Navy has a caliber of 0.236 in.; will fire 5 projectiles in 3 seconds, or 25 in one minute, and will impart to these bullets a velocity of 2,400 ft. per second, equal to a penetration at 500 yds., of 23 ins. in pine. It will kill a man at 3,000 yds., and the point-blank danger space is 700 yds. The barrel is made of forged steel, with 4½% of nickel added. The rifling consists of 6 equal grooves, .004 in. deep, with a uniform twist of one revolution in 7½ ins. The entire length of the gun is 42 ins., and the weight of gun and bayonet is about 8½ lbs., the bayonet being of the knife pattern, 12 ins. long and 1¾ ins. wide, so that it can be used as an intrenching tool. To illustrate the effect of the compressed leaden bullet with its thin steel jacket, Captain Sampson, Chief of the Naval Ordnance Bureau, says that if fired through the side of an open-topped bucket filled with water, the iron hoops will be ruptured, showing that the energy due to the enormous velocity is imparted to the elastic particles of the fluid, which are driven against and burst out the sides of the bucket. He says the same thing will happen when human organs are penetrated containing similar fluids. If this ball strikes a bone the lead will bulge and the jacket split, creating a more serious wound than would result from the old slow-moving bullet of 0.45 in. caliber.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Published every Thursday at Tribune Building, New York.
Entered at the Post Office, New York, as Second Class Matter

D. McN. STAUFFER, CHARLES WHITING BAKER.....EDITORS.
WM. KENT, E. E. R. TRATMAN, M. N. BAKER, CHAS. S. HILL, A. B. GILBERT.....ASSOCIATE EDITORS.
CHAS. W. REINHARDT.....CHIEF DRAFTSMAN.

GEO. H. FROST, F. P. BURT.....BUSINESS MANAGERS.
ALFRED E. KORNFELD, New York; F. A. PECKHAM Chicago.....ADVERTISING REPRESENTATIVES

PUBLICATION OFFICE.....Tribune Building, New York.
CHICAGO OFFICE.....1636 The Monadnock.

LONDON AGENCIES: KEGAN PAUL, TRENCH, TRUEBNER & Co. (Limited), Paternoster House, Charing Cross Road; SAMPSON LOW, MARSTON & Co. (Limited), St. Dunstan's House, Fetter Lane.

SUBSCRIPTION RATES: United States, Canada and Mexico, One Year, $5.00: 6 months, $2.50: 3 months, $1.00 single copies, 15 cents. To all other countries in the Postal Union, add $2.08 per annum (4 cents per number) to above prices for postage. No club rates allowed. Mailing addresses may be changed at will by sending both old and new address. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay. The date when the subscription expires is on the address label on each paper: the change of this to a subsequent date is the only receipt sent, unless by special request.

ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 20. Rates for standing advertisements sent on request. Changes of standing advertisements must be in hand on Monday afternoon: new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

In this issue is given an abstract of the alleged report of the Nicaragua Canal Commission, as published in the New York "Herald." Assuming that it is generally correct, the report is very far from favorable to the canal, as located and estimated upon by the Nicaragua Canal Company, and the changes proposed practically double the cost of the canal as figured by the engineers of the canal company. With due allowance given to the admitted insufficiency of data and to the intricate conditions surrounding the problem, many of the suggestions made are eminently wise and would tend to the construction of a better canal. Included in these suggestions are the proposed deepening and widening of the channel, the formation of passing points, the reduction in lock lift, and the providing of more ample and deeper terminals. This journal has for some years past maintained that fuller surveys of the area to be traversed and a longer and more exhaustive study of the natural conditions controlling this enterprise were essential before any correct final project and estimate of cost could be presented to the public. With this view of the case the Canal Commission fully agree, and to supplement the unusually full surveys already made for this canal by the U. S. Government and by the canal company, a further expenditure of $250,000 and 18 months' time are recommended. If the world is to have a ship canal across Nicaragua the commercial interests of all concerned demand that this canal should be the best in location, the safest and the most economical to operate that the topography of the country will permit or that the skill and experience of the ablest engineers can devise. Nothing else should be permitted; and to secure these results in the final plans and construction, the fullest preliminary investigation is absolutely essential. This investigation, to be of real value, will cost much money and time; but the expense thus incurred is in the end economical, and to go ahead upon construction without this previous knowledge is to invite disaster. At Panama, construction practically preceded full and properly-digested plans; the world knows the result, and American canal builders should benefit by the lesson taught.

The deliberate wrecking of a train on a trunk line near one of the important cities of New York state, and the consequent death of two men, the injury of ten others, and the destruction of valuable property and mail matter, ought to bear fruit in the shape of better laws for the adequate punishment of those who place lives in jeopardy by train wrecking. The cold-blooded act of the youthful criminals who caused the wreck will be punished, it is to be hoped, as it deserves, and no sympathy for the parents of the authors of the crime should be allowed to hide the fact that the prompt and sufficient punishment of such a murderous crime is a necessity as a warning to others. But the sad accident ought also to serve to call general public attention to the serious menace which exists in the increasing prevalence of train wrecking, and in the need of better protection against it in the statute laws. California has already a law in force by which attempts at train wrecking are a capital offense, whether death results from the wreck or not. In view of the fact that the human fiend who deliberately plans and carries out a train wreck does so in the full knowledge that his act may cause the death of from one to a hundred or more innocent persons, such a law cannot be called by any means too severe. It is true that the experience which railway managers have had with state legislatures during the past dozen years may well tend to make them doubtful whether the demand from the railways for laws to better protect against train wreckers would not be made an excuse for the levy of blackmail. But the demand ought to be made, nevertheless, and ought to, and we believe would, receive the support of strong public opinion. The train wrecker is a foe to public safety, and if California, the most rabid anti-railway state in the Union, can pass laws to properly punish train wrecking, it ought to be easily possible to pass similar laws in other states.

The earnings of the Manhattan Railway, New York city, for the past five years, are an admirable illustration of the effect of poor accommodations in driving away traffic. We gave last week the company's report of earnings for the year ending Sept. 30, 1895, and as a matter of general interest present herewith the following little summary of the company's net earnings for five years:

Fiscal year.	Gross earn'gs.	Net earn'gs.
1890-1891	$10,174,935	$4,566,906
1891-1892	10,908,578	4,943,689
1892-1893	11,137,050	4,926,890
1893-1894	10,138,143	4,043,086
1894-1895	9,745,926	3,613,099

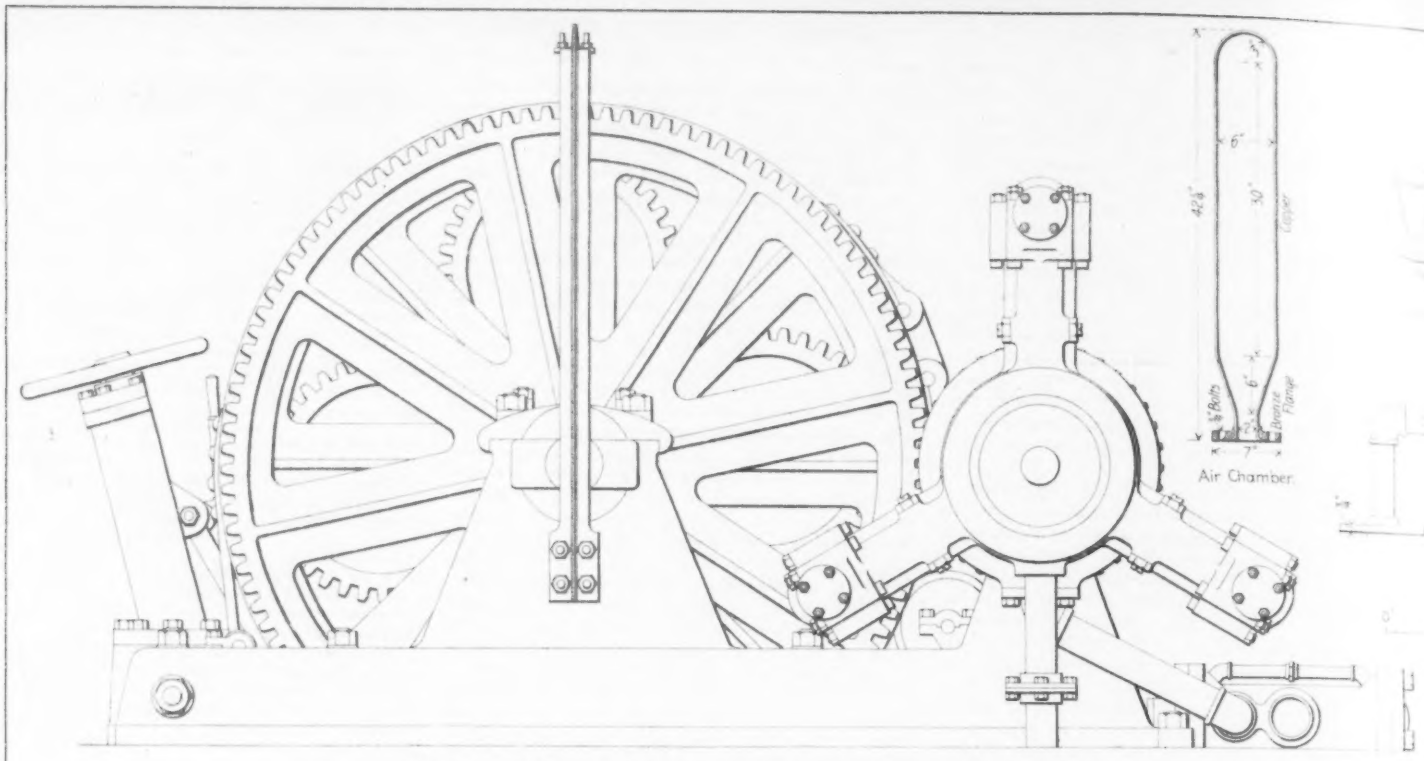
As the above table shows, up to 1892-3 the traffic on the Manhattan lines showed a steady growth, notwithstanding the poor service which the company furnished, simply on account of the fact that there was no other means of transport available, and the traffic naturally grew with the growth of the city. In 1893-94 there was a material drop in traffic, which was then said to be due to the business depression of that period. The report for the year just closed, however, shows that instead of the company regaining this traffic with the improvement in business, the falling off has continued, and the net earnings last year were $1,300,000, in round numbers, less than two years ago. As everybody knows, this is due to the competition of the surface roads, especially the Broadway and Third Ave. cable lines; and a point which deserves especial notice is that, to a very large degree, the falling off in the elevated traffic is due to the contrast between the excellent rolling stock of the cable lines and the abominable Manhattan cars. The cable lines do not make very much better time than the old horse cars did, and the "catapult" motion with which they start makes them far from easy riding; but, on the other hand, they are kept clean, are well upholstered, have attractive interiors, and, what is probably most important of all, they are brilliantly lighted with gas lamps. The elevated cars, on the other hand, are perennially filthy and dingy. The lighting has so long been a byword of reproach to the Manhattan managers, and is such a source of injury to those who are forced to patronize the road, that it ought long ago to have been remedied by compulsory action on the part of the State Railroad Commission or the city authorities, or by legislative action, if necessary. Four-fifths of the patrons of city transit lines are accustomed to read as they go to and from their business, and it is small wonder that thousands have forsaken the dimly-lighted elevated trains for the brilliantly-lighted cable cars, even at the expense of a few minutes longer time on the road

Were the Manhattan system to do no more than to properly light its cars and keep them clean—improvements which it could make at trifling cost—it is altogether probable that it would regain a good part of the million and a quarter dollars of annual revenue which it has lost. But so long as the millionaires who are the chief owners of the Manhattan system are satisfied to pursue their present course, dignified by the name of conservatism, they will probably have to continue to endure their diminished earnings with such equanimity as they can.

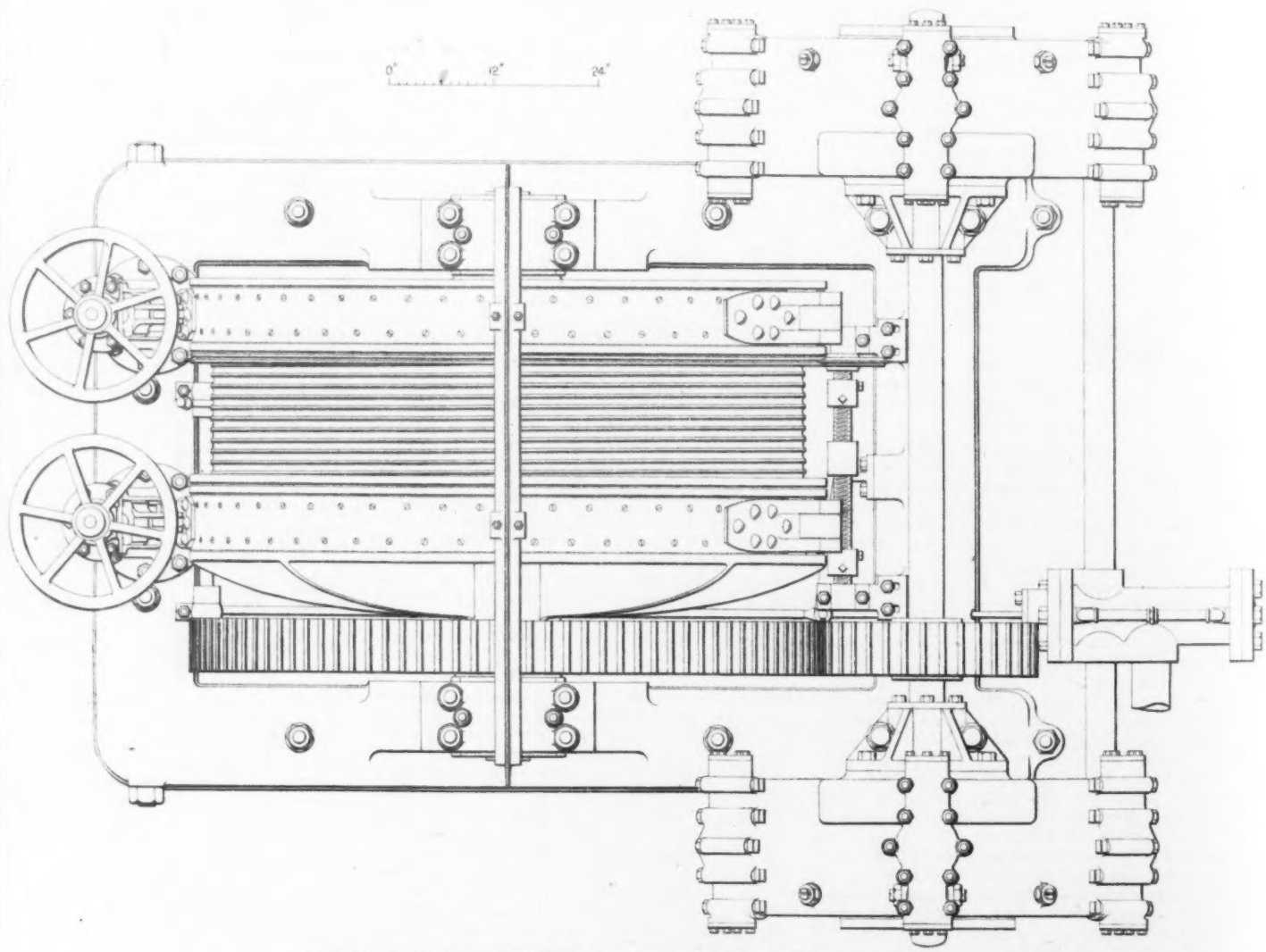
The complaints of excessive freight rates by the citizens of California, and their attempts to secure lower rates by compulsory action of the state railroad commission and by building a competing railway from San Francisco down the San Joaquin valley, have been generally set down as merely manifestations of the same hostility to railways on the part of farmers and shippers that has been so generally displayed in most of the Western states during the past dozen years. A recent issue of the San Francisco "Chronicle," however, gives particulars of the starting of freight wagons to compete with the Southern Pacific in the carriage of goods between San Francisco and the San Joaquin Valley. According to that journal, the Southern Pacific's rate on sugar from San Francisco to Fresno, a distance of 207 miles, is 51 cts. per 100 lbs., or $10.20 per ton. This is equivalent to 5 cts. per ton-mile. This excessive charge has caused one wholesale grocery firm to ship its sugar by steamer to Stockton at a cost of $1 per ton, and thence by six-mule freight wagons to Fresno, a distance of 146 miles. It is claimed that the freight wagons can make this haul for $5 per ton, or about 3.5 cts. per ton-mile. It seems doubtful whether the cost of haulage over common roads could be brought so low as this, but it is quite likely that freighters could afford to do the work for 5 cts. per ton-mile, the same rate as the railways.

If the statement as to the Southern Pacific's rate is correct, it would seem that the complaints of excessive charges which the citizens of California have long been making have some ground of justification. Any railway which charges freight rates so high as to permit mule teams to compete with it is pursuing an indefensible course, and one which in the long run will prove to be against its best interests.

The interesting example of rubble concrete work at Wright's Tunnel, on the Southern Pacific R. R., which is described in another column, affords practical evidence of the saving in the cost of concrete work—without materially reducing its strength—by imbedding in it large stones, to which attention was called in our issue of Oct. 17, 1895. Unfortunately, the figures given are not so complete as could be wished, but they serve to illustrate the point we then wished to make. In the work described, rubblestone could be placed in the work at a cost of 60 cts. per cu. yd., while a concrete of no more than ordinary quality cost $6 per cu. yd. Assuming that in the completed work 30 per cent. of the volume was rubblestone, which is a very fair assumption, the saving by using rubble was $1.56 per cu. yd., or 26 per cent. It will be seen that the rubble concrete was used only in the bottom walls, which carried a practically static compressive load, and where the lack of homogeneity due to the use of rubble cut no important figure. In the tunnel arch subject to complex stresses, lack of homogeneity would have been an important matter, and here the engineer used the ordinary small broken stone concrete. While important advantages may be gained in reduced cost by using rubble concrete, its limitations must be borne in mind. For foundations or other large monolithic constructions bearing static loads, it will in most cases answer all demands for strength, and, besides, save considerably in cost over the broken stone concrete without rubble fillers.



SIDE ELEVATION OF HYDRAULIC WINDING ENGINE FOR OPERATING GATES.

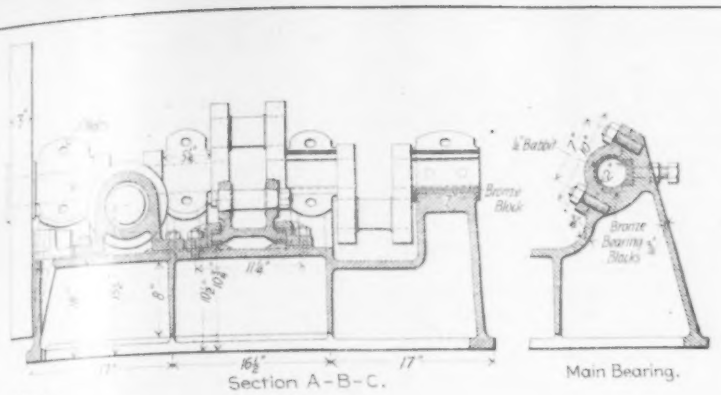


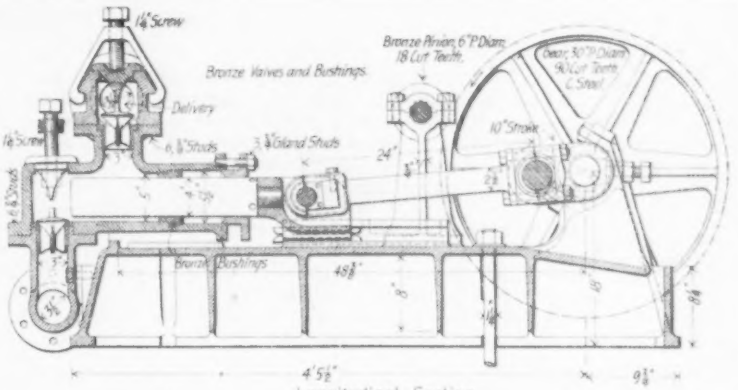
GENERAL PLAN OF HYDRAULIC WINDING ENGINE FOR OPERATING GATES.

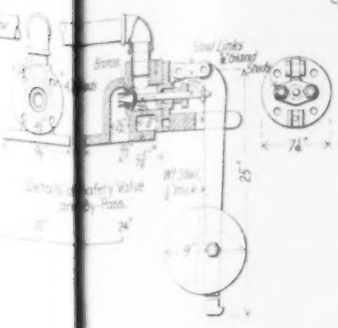
GATE OPERATING MACHINERY FOR THE U. S.

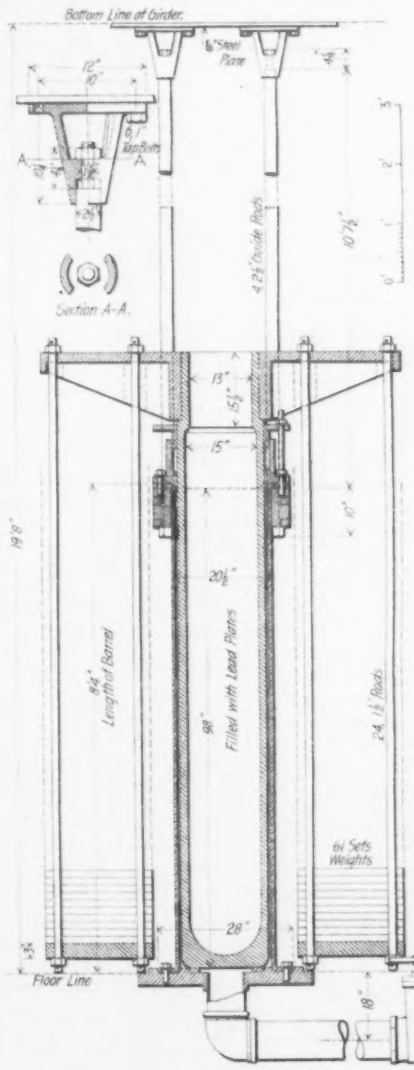
Col. O. M. Poe,* U. S. Engineer Corps, Engineer in Charge of Navigation Improvements on the Great
Frank M. Dunlap, M. Am. Soc. M. E., Det

*Died October 2, 1895.

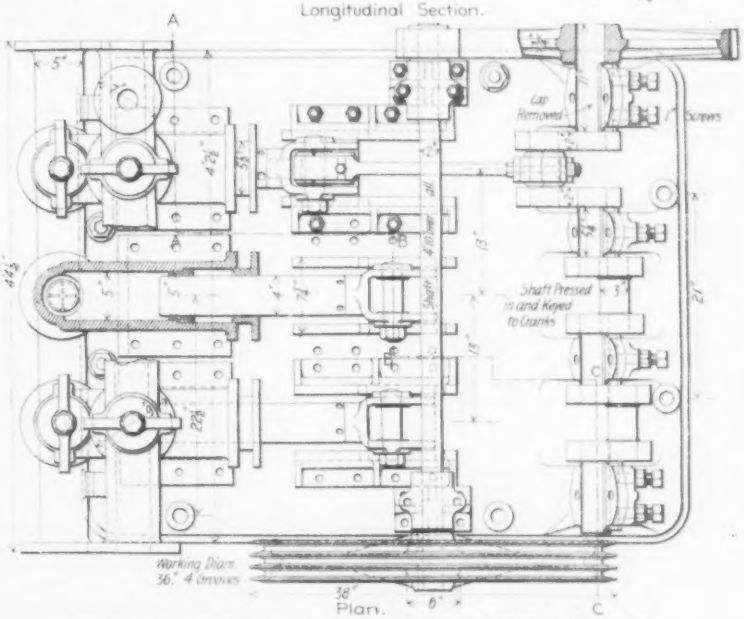




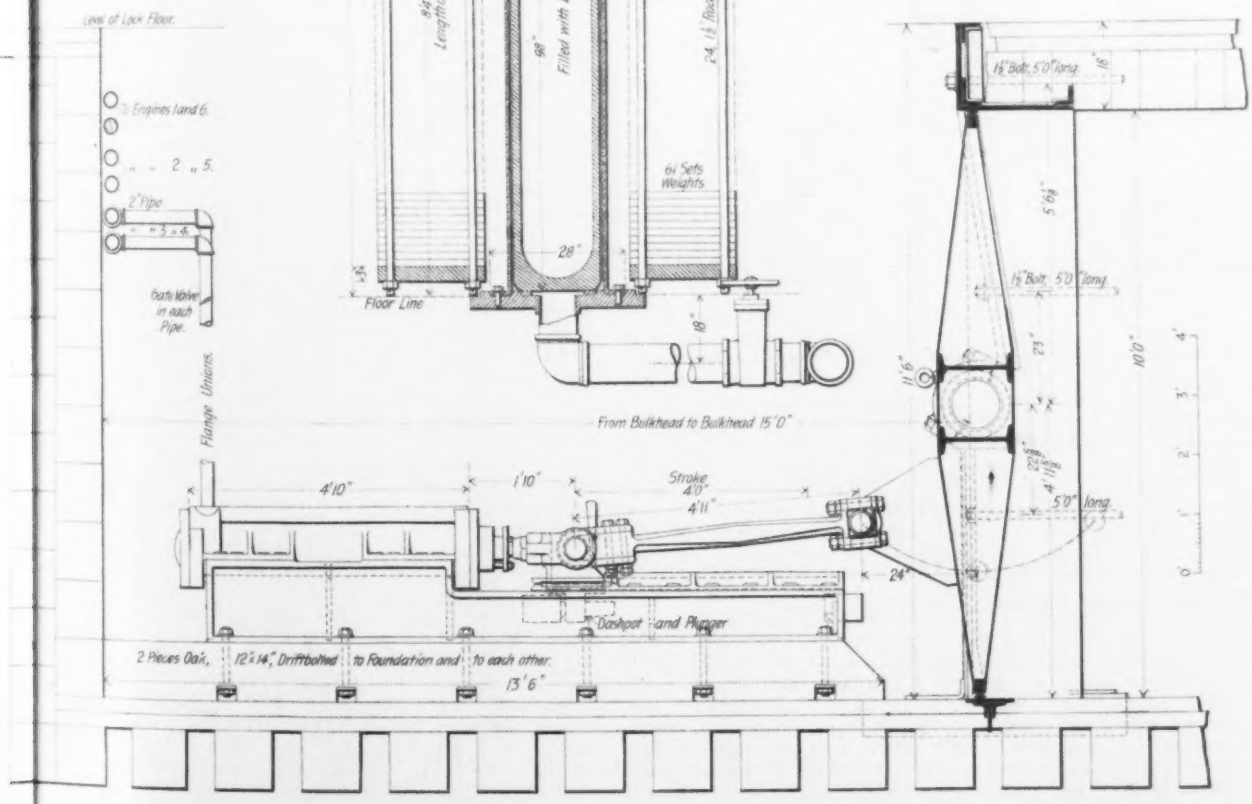




HYDRAULIC ACCUMULATOR.
VERTICAL
SECTION.



DETAILS OF HYDRAULIC PUMPS FOR SUPPLYING PRESSURE
TO OPERATE VALVE AND GATE ENGINES.



HYDRAULIC VALVE ENGINE. ELEVATION SHOWING THE RELATION AND CONNECTION OF ENGINE TO VALVES.

E U. S. GOVERNMENT LOCK, SAULT STE. MARIE, MICH.

he Great Lakes. E. S. Wheeler, M. Am. Soc. C.E., U. S. Asst. Engineer in Charge of Work on St. Mary's River.
. E., Detroit, Mich., Designer of Hydraulic Machinery.

CHAS. HART & SONS, LITH., 26 VESEY ST., N. Y.

Senator Chandler, of New Hampshire, is still continuing his attacks upon the proposed Joint Traffic Association. His latest appeal is to President Cleveland himself, and he urges him to use his "personal influence" with Mr. J. Pierpont Morgan to prevent the final consummation of the new traffic compact. A careful reading of Mr. Chandler's various published letters on this subject compels the conclusion that either he is so densely ignorant as to sincerely believe in the position which he takes, or else he is bidding for political popularity by posing as the friend of the people and the foe of the railways. It is difficult to say which position is the more discreditable to a member of the United States Senate. .

Doubtless Mr. Chandler would prefer to claim that he is sincere in his numerous philippics against the railways. But if that be true his unfitness for his position is quite as evident as if he prefers the other horn of the dilemma. It is as much the business of a public legislator to have an intelligent knowledge of at least the elements of political economy as it is the business of an engineer to understand at least the elements of mathematics. It is as ridiculous for Mr. Chandler to parade the economic knowledge of twenty years ago in support of his position as it would be for an electrical engineer to attempt to carry on work with no better knowledge of electricity than was current in 1876.

The recent pensioning of the Chief Engineer of the London, Brighton & South Coast Railway, in England, is a matter worthy of special notice and an act by a great corporation that could and should be imitated more frequently in the United States. Mr. Frederick Dale Bannister first entered the service of the London & Brighton Company in 1846, though he was in private practice as an engineer from 1850 to 1860. But in the latter year he was made Chief Resident Engineer of the present organization, and in that capacity he has been identified with all the important improvements undertaken by the company for the last 34 years. In 1891 he met with an accident which much impaired his health, but the directors were unwilling to lose his services, and retained him in his position. When he lately declared that he could not, with fairness to them or to himself, continue any longer his onerous duties, the board reluctantly accepted his resignation, placed on record their appreciation of his long and valuable services, and granted him a pension of $5,000 per annum. This action is highly creditable to both parties interested; it properly recognizes long and faithful service; but it is more especially creditable to the corporation which performs the act, and thus attests that it, or rather its directors, are by no means soulless.

Two bids recently received for an electric lighting franchise at Webb City, Mo., suggest the inquiry whether in granting franchises the aim should be to secure the lowest possible rates for public and private service, the highest possible percentage of the gross receipts, or a combination of these. In the case of street railways, a five-cent fare is almost invariably the rule in this country, and such modifications as exist in the way of bunches of tickets at a reduced price seldom if ever constitute an equivalent to a cash payment in return for a franchise. The fare for a large majority of the passengers being fixed at an arbitrary figure, and the railway company rendering no strictly public service, like hydrants for fire protection or street lighting on the part of the water and gas companies, respectively, it must pay directly for the privileges received, instead of indirectly through reduced prices for service.

The two bids received at Webb City offered 2 and 2¼ per cent., respectively, of the gross receipts in return for the franchise. The population of the city in 1890 was 5,043, having increased to this figure from 1,588 in 1880. The yearly sum derived from either of the above percentages must of necessity be small. Would not the city have received more and better bids had it asked for competition in rates, and would not there have been a most decided advantage in having a definite schedule of prices for private lighting laid down in the franchise when granted? Questions like these have scarcely begun to be considered by American municipalities, but their importance demands that they should no longer be neglected.

In considering the above question, it must be remembered that in the smaller cities and towns only a fraction of the population patronizes the electric lighting service, while the whole taxpaying community is affected by the grant of the franchise, so there is some reason for securing a return for the franchise which will benefit all the taxpayers. Another point in favor of the gross receipts plan is that as the earning power of the plant increases, so does the payment to the city, while the usual practice where rates are specified is to make them hold good for the full life of the franchise. In an enterprise of this character, where competition is often absent, such a course might deprive the citizens of lower rates or increased returns, as the cost of production decreased and the earning power increased, unless the company paid a percentage of the gross receipts. Of course the franchise might specify a given reduction of rates at the end of each five-year period, but there is no experience to indicate that this plan would be well received by bidders for franchises, or satisfactory in its results.

We are indebted to Mr. J. J. Funk, Mayor of Webb City, Mo., for the figures given above as a result of the bidding in the city named.

The question, "Upon what conditions—chemical or other—do the strength, softness and other desirable qualities of cast iron depend?" is one which has always puzzled founders and engineers. Until recently, no attempt has been made to give a scientific answer to it, and in order to obtain castings of any given quality, it has been necessary to depend entirely upon the "practical experience" of the founder, and his knowledge of what "brands" and numbers of iron to select for the mixture, and of what treatment to give the iron in the cupola. In the past few years great advances have been made in our knowledge of cast iron, with the economical result—worth many millions of dollars to the country—of the substitution of low-priced coke and anthracite pig irons for the more expensive charcoal irons. The production of charcoal pig iron in the United States is now less than 2½ per cent. of the total. The chemists have taken hold of the problem, and have shown that silicon is the most important element in influencing the strength. The paper by Mr. W. J. Keep, M. Am. Soc. M. E., an abstract of which is given on another page in this issue, shows that the law connecting the percentage of silicon with the strength is a complex one; that the influence of silicon varies with the size of the casting. There is a vast amount yet to be learned concerning cast iron, and Mr. Keep's paper deserves careful perusal by all who are interested in its subject.

The rapid increase of our new navy seems to open the door to a number of civilian appointments as officers in charge of the steam engineering of our warships. In his late annual report, the Chief of the Bureau of Steam Engineering, Commodore George W. Melville, calls especial attention to the fact that the number of graduates from the Engineer Division of the U. S. Naval Academy is not sufficient to fill the vacancies caused by deaths, retirements and resignations. Mr. Melville goes on to say that unless some means can be found for increasing this division of the Academy, recourse must be had to the technical schools of the country. Thanks to class friction, due to tradition and a lack of appreciation among many line officers of the full meaning of the present revolution in naval warfare, the Engineer Division of the Naval Academy is not as popular as it should be among the young cadets. They prefer to graduate as line officers, and as a consequence the steam engineering staff suffers. To what extent this unfortunate misunderstanding of the true worth and dignity of the office of a steam engineer on a modern warship can be removed by the proposed reform in the personnel of the U. S. Navy has yet to be determined, and will probably be determined by the amount of influence which certain line officers of the old school can bring to bear upon this legislation by Congress. But as time goes on, the efforts of Commodore Melville and other enlightened officers—of the line as well as of the staff—must bear fruit, and the real importance of the officer who has responsible charge of much of the fighting, as well as all of the navigating machinery of the sailless warship of to-day, will be recognized. Meanwhile we are adding new ships, and must have officers in this particular class to man them; and as the young cadets are mostly influenced by the traditions of the past, and are slow in recognizing an advance in which as yet they have no part, the prospects are that it will be necessary to call on the graduates of technical schools, as suggested by Commodore Melville. It is an honorable field of duty, and the friction now prevailing must soon pass away along with the old ships, old officers and old traditions concerning the respective social rank of the line officers and their staff assistants.

REPLACING TRESTLES WITH EARTHWORK.

The great extent to which timber trestling has been adopted in this country is one of the principal factors in the economy of construction and rapidity of completion which have been characteristic of American railway work. The use of such temporary structures has been justified by the necessity of keeping the first cost of long lines as low as possible, and by the importance of putting the companies in a position to earn money by carrying freight as soon as possible. Well-built trestles are safe and substantial structures, but all timber structures require frequent attention and repair, and are liable to be destroyed by fire, causing, perhaps, train wrecks and serious interruption to traffic. When once a railway is open, attention should therefore be given to the work of gradually substituting solid banks (with culverts or metal bridges over streams) for timber trestles, as the banks will be permanent and will require practically no repair or attention—under ordinary circumstances. This filling can almost invariably be done much more quickly and cheaply by work trains after the completion of the road than by the ordinary plant used while the line is under construction.

The importance of this system of rapid first construction with temporary works and subsequent replacement of such works by permanent works has been shown very strongly by the experience of the Canadian Pacific Ry. This company made a contract with the Canadian Government on Oct. 21, 1880, to complete the line to the Pacific coast in ten years, and the work was pushed with such energy that trains passed between the St. Lawrence River and the Pacific Ocean in November, 1885. According to a statement made by Mr. P. Alex. Peterson, Chief Engineer, it was decided, in carrying out the construction through an almost inaccessible wilderness, to construct a large amount of temporary work, which would carry the traffic safely for some years, and would subsequently be of material use in the economical construction of the permanent works. This method of carrying out the work enabled the company to open the line five years earlier than it could otherwise have done; it saved a large amount of money in first cost and interest, it will effect a large saving in the ultimate cost, and it enabled the company to earn $20,000,000 in the year fixed for the completion of the contract.

It is sometimes claimed that the ultimate cost of an earth bank will be less than that of a trestle, the annual interest upon the money expended upon the earthwork being less than the annual cost for repairs and renewals to trestlework, while at the same time there is always an element of danger in the possible destruction of the trestles by fire, and the delay to traffic in such cases is liable to increase the ultimate expense of the trestlework. On the other hand, the urgent need for completing communications, the desirability of commencing traffic at the earliest time, the economy in first cost, and the greater facilities for permanent construction which are afforded by the temporary works, have in very many cases amply justified the adoption of this system, although it must be admitted

that in some cases the filling in of the trestles has been postponed longer than it should have been. It must also be borne in mind that the profits earned during the time between the completion of the trestles and the time at which solid banks would have been completed must be taken into account. In this discussion we are supposing that good, substantial and well-founded trestles are built, and are properly watched and repaired, but if the trestle is designed to be used only a short time (which is, however, rarely the case) the foundations may be of a simpler and cheaper character than where the structure is intended to be in use long enough to require the renewal of some of its members. It may be noted that in view of the economy in time and expense which can be secured by making banks by filling from trestles, as compared with working from the ends of the bank, the practice is sometimes followed of building a light and rough temporary trestle as a "falsework" for the construction of an earth bank. Such a trestle may be built of old bridge timbers or other second-class timber, or of beech, sycamore or other cheap piles, capped by old bridge timbers. The stringers, however, are usually new timbers, and are removed when the bank is completed. It is also to be noted that if much work of widening bad cuts, etc., has to be done, the material may economically be used in filling trestles which were originally built to remain for some years. This has been done on the St. Louis, Keokuk & Northwestern R. R. (C., B. & Q. R. R. system), where two double-deck frame trestles, 20 to 60 ft. high, and about 1,000 ft. long, have been filled by material obtained in the way noted above, although they were intended to last for seven or eight years.

In regard to the construction of earth banks as substitutes for existing trestles, it is often assumed that no particular skill is required or difficulty involved beyond the proper handling of the gravel trains, the idea being that it is simply a case of dumping the earth and keeping the trains out of the way of regular trains. This is doubtless true in many cases where the ground is hard and of an easy slope, but on soft ground or steep slopes the work of filling calls for very careful consideration. Some of the difficulties met with in extensive work of this kind on the Canadian Pacific Ry. are described in another column of this issue. Here two specially troublesome kinds of soft bottom were met with. In one case the bottom was practically unfathomable, and swallowed up all the filling until the successful expedient was adopted of using light sawdust instead of heavy gravel for filling. In the other case, the soft bottom rested upon a sloping rock bed, down which the bank would slide. In some cases the alinement was changed to avoid the most troublesome and dangerous places (and it is to be noted that it was sometimes found possible to get a better location on firm ground than the original location on treacherous ground), but in many cases the difficulties were steadily fought until overcome, as described in the article above referred to.

In no case should such work be commenced until careful investigation has been made as to the conditions to be met, or the result may be the loss of money, time and material, or the wrecking of a structure and a costly interruption to traffic, as the dumping of material in a swampy bottom may develop unexpected upheavals in a more or less distant part, which may lead to damage suits or involve the compulsory purchase of real estate. Not only has the foundation to be considered, but also the trestle itself. Thus, in the case of a long structure, especially if the longitudinal bracing is deficient, as is too often the case, it is not safe to fill in from the ends or from one end, as the pressure may result in the injury or collapse of the trestle, but the filling must be carried on uniformly along the length of the trestle, thus maintaining a practically horizontal surface for the fill and preventing the straining of the structure. Again, if the earth or gravel is to be plowed off the cars in the usual way, the strength of the trestle is an important consideration in regard to the resistance to the racking strains, and to the lateral strains if a side plow is used, especially if the material is stiff and the cars are chained to the track. A plow being hauled over a car and suddenly striking a bowlder or other obstruction may throw very severe strains upon a trestle. This is more particularly the case where the trestle is on a curve. The strains due to plowing off the material may be considerably reduced by using a "rapid unloader," with a steam winding engine on the front car, as described in our issue of Oct. 6, 1892.

On this work there are many dangers to the laborers, if hand shoveling or hand dump-cars are employed, there being the constant liability of a man falling from or being knocked off the structure. This is especially the case when hand dump cars are used on high trestles, the floors being usually narrow, and the men likely to stumble, get dizzy or be struck by the moving body of a car. In order to provide against these dangers on the Canadian Pacific Ry., an investigation was made into the question of fitting dump cars with mechanism operated from the engine, either by steam (as in car heating) or by air (as in train brakes). At that time, however (1891), no such device was in practical use, but an apparatus was designed by the company's officers (on the basis of an unapplied United States patent) by which the cars were dumped by compressed air. Trains of 20 cars operated in this way were put in service in 1892, with satisfactory results, and these are said to have been the first railway dump cars so operated. Since that time, however, two or three systems of dumping cars by compressed air have been introduced and used to some extent in this country. The principle consists in attaching to the bottom of the pivoted body of the car the piston rod of a cylinder, connected by a train-pipe and hose couplings with the air reservoir on the engine. Some of these cars have been used on the Chicago Drainage Canal and other works, as noted in our issues of Sept. 14, 1893, and June 27, 1895.

A very effective and economical method of filling where water is obtainable under considerable head is that of washing earth into place from the hillside above the trestle, using a water jet from a monitor in the same way as in placer mining. This method has been employed on the Canadian Pacific Ry. and Northern Pacific R. R. To prevent the water from flowing away too rapidly over the fill, carrying away with it the earth brought down, and also washing channels in the side of the fill, a bank 6 to 8 ins. high, of earth mixed with hay and straw, or a line of old ties, is placed along the edge of the fill, the earth being deposited behind it and the water flowing over the top. The bank is renewed on the slope as fast as the filling reaches the top. The water and earth are carried down to the fill by a flume, the lower end of which is movable, and the flow from the mouth of the flume can be directed to any desired part of the fill by the use of movable flashboards or guideplanks, set on edge. Such work has been done at a cost of 5 to 7½ cts. per cu. yd. of material in the bank.

The timberwork of the trestle itself remains in place in the bank, but the floor system (consisting of the ties and stringers) is taken out. On the Canadian Pacific Ry.the practice is to fill up to the level of the tops of the ties in the autumn of one year, and then in the spring of the next year, after the frost is out of the ground, the ties and stringers are removed, and those that are sound are used in repairing old trestles.

In a communication received from Mr. Peterson, Chief Engineer of the Canadian Pacific Ry., it is stated that height has no effect upon the cost of the bank or trestle beyond the actual quantity of earth or timber therein. In a length of 105 ft. of trestle on this road, the floor system includes 20,000 ft. of timber, 2,555 lbs. of wrought iron and 119 lbs. of cast iron, while the quantities in a 105-ft. length of the trestle proper are as follows:

Height of trestle, ft.	Timber, ft.	Wrought iron, lbs.	Cast iron, lbs.
10	7,000	511	175
20	12,000	511	175
30	20,500	665	219
50	38,000	1,225	448

He also states that it is very difficult to say at what height the cost of the trestle and the cost of the bank are approximately the same, as in some places the price for timber may be high and that for excavation low, while in other places the conditions may be reversed. In the original work on this line there was no case in which the cost of the trestle was not less than that of a bank, but at the present time, when trains, steam shovels and pneumatic dump cars are in use, the cost of the bank has been brought very low. Mr. Dauchey, Superintendent of Maintenance and Construction of the Chicago, Rock Island & Pacific Ry. (lines west of the Missouri River), states that of course the cost of both bank and trestle increases with the height, the increase in the former being directly proportional to the increase in cubic contents, while the increase in the latter depends largely upon location, facilities of erection and site. He considers the ultimate cost of bank at all heights cheaper than that of trestle, taking into account the annual interest upon the greater cost of the bank, the annual charge for repairs and renewals of trestle, and the liability to delay of traffic by the burning of the trestle. We are indebted to Mr. Dauchey for the following statement of work done in filling trestles in 1894 on the lines under his charge, and the work thus far done in 1895 is exceeding that done in 1894 by about 50% in the total length of bridging or trestling filled. The prices given are from the actual figures for such work in 1894:

Statement of Bridges Filled and Replaced by Permanent Structure during 1894; C., R. I. & P. Ry. (Lines West of the Missouri River).

			Ft.
Bridges filled	No., 125;	length,	7,356
" shortened ..... "	51; amount shortened,		3,273
" replaced by iron. "	4;	length,	403
Total			11,032
First cost of 11,032 ft. of bridge, at $6.42			$70,825.44
Cost per year to build (life, 7 years)			$10,117.92
" " " to repair, at 23 cts.			2,537.36
Cost of construction and repairs per year ..			$12,655.28

Cost of Permanent Structures and Filling.

412.7 tons of cast iron pipe, at $19	$7,841.30
407.9 " " " " " " $20	8,158.00
Masonry in arches, culverts and foundations.	44,565.84
Iron bridge work	6,038.62
Filling bridges	35,537.71
Total	$103,041.47
Annual interest at 5% on $103,041.47	$5,152.07
Net saving per yr. by use permanent struct's..	7,503.21

In connection with this question of the cost of trestlework, we give the following quotations from the late A. M. Wellington's book on "The Economic Theory on Railway Location":

At somewhere from 10 to 15 ft. of height of fill, such a structure (wooden trestle) becomes cheaper in cost than even a plain earth fill; and when, in addition to the fill, there would have to be a masonry structure, or when, if it were not for the trestle, the grade would have to be dropped or the line swung in so as to give a rock cut (or even a heavy earth cut) at each end of it, the trestle becomes very much cheaper, and its free use affords us a solid and safe roadway for immediate use which can be continued in the same form indefinitely, if poverty requires it, or which can be advantageously and economically replaced by more permanent structures at any time, using trains to make the fills and supply the stone.

In any wooden trestle the caps and all the floor system above it, as also the minimum length of sill and all wooden parts below it, are directly as the length of the structure, and independent of its height. The same is true of the cost of digging foundations, and the piling or masonry if used (as one or the other always should be). At a certain distance below the cap, say, 10 ft., there is a system of longitudinal, transverse and diagonal ties and sway-brace running the entire length of the structure on a line about 10 ft. below the caps, and (constructively) a certain addition to the length of the sill. All this may be expressed at so much per lineal foot on a horizontal line 10 ft. below the grade line. Ten feet farther down there is a similar system, nearly duplicating the first, but a little larger, which may be all expressed at so much per lineal foot on a horizontal line 20 ft. (or whatever the distance may be) below the grade line. So we may proceed until we have provided for the highest trestles likely to occur on the line of the given type, and we shall have expressed the feet board-measure in any width in an equation of the following form:

$$\text{Ft. B. M.} = f\,L + f'\,L' + f''\,L'' + \text{etc.},$$

in which L L' L'' = the respective lengths of the structure on the grade line and on parallel lines 10, 20, 30 ft., etc., below it, and f f' f'' = the corresponding measurement per lineal foot.

Returning to the question of the comparative cost of permanent earthwork construction in the first place, and temporary trestling, followed later by

permanent earthwork, it may be noted that a report on the physical condition of the Lake Erie & Western R. R. in 1894 (Eng. News, April 25, 1895) states that the cost of standard frame or pile trestles, say, 15 ft. in height, is about $7 per foot run, and their average life is nine years. The cost of permanent structures, where iron pipe culverts or stone arches can be used, and the height does not exceed 15 ft., is said to be but little more than the cost of a trestle, and seldom exceeds twice the cost, including the cost of filling the opening with earth. For longer openings, where plate girders and masonry are necessary, the cost is little more than twice, and seldom exceeds three times the cost of a trestle. The cost of filling with a steam shovel and an "unloader" plow, in 1894, was about 12 to 14 cts. per cu. yd., including wages of train crew and laborers, fuel, oil, waste and repairs. In this connection it is of interest to refer to a paper on "Temporary Trestling and Its Economy as Compared with Earthwork," published in our issue of March 25, 1876. Taking one particular case it was shown that the total cost of the trestle was $11,708, while immediate permanent work would have cost $55,042 of which $27,042 was for the fill and $28,000 for two stone arches of 30 ft. span). Permanent construction six years later (when material for the fill could be obtained by widening narrow cuts and flattening steep slopes, instead of being procured from borrow pits) would cost $49,366, and the actual ultimate saving would thus be $5,676 in capital cost, or $28,920 in all. These figures we may tabulate at follows:

First construction:		
Earthwork (at 28 cts.)	$27,042	
Openings in bank	28,000	
Total for immediate permanent construction		$55,042
Trestle		11,708
Saving in capital cost by trestle		$43,334
Gradual construction:		
Trestle	$11,708	
Filling trestle (at 10 cts.)	9,658	
Openings in bank	28,000	
Total		$49,366
Sav'g over cost immediate permt. const.		($5,042). $5,676
Comp. int., 8% on $28,000, 6 years		$16,432
" " " " 9,658, 4 "		3,481
" " " " 5,676, 6 "		3,331
Total saved in interest		$23,244
Total saving by trestle replaced by bank		$28,920

In this particular trestle the cost of timber in the bents, including framing and erection, was $40 per 1,000 ft. B. M., while the total cost, including iron, foundation, engineering, etc., was $53.90 per 1,000 ft. B. M. The following table, based on the above prices, was given, showing the comparative cost of a trestle and an earth bank for different heights. Similar estimates can be made for any design of trestle and any prevailing prices of trestle and earthwork.

Height, ft.	Lumber, B. M., per 16' lin. ft.	Cost of trestle, at $53.90 per M. B. M.	Bank, 16 ft. lgth., 10% shr'kage, cu. yds.	Cost of bank, at 28 cts. per cu. yd.	Ratio of cost of trestle(1) to bank.
17	1,941	$104.60	415.6	$116.36	1.11
22	2,201	118.62	645.3	180.60	1.51
27	2,605	143.65	924.0	258.72	1.80
32	2,964	159.70	1,251.6	350.94	2.20
37	3,478	187.46	1,628.0	455.84	2.43
42	3,808	205.25	2,053.3	574.83	2.80
48	4,392	236.73	2,628.3	735.80	3.11

LETTERS TO THE EDITOR.

THE PUBLISHER OF "TRANSPORTATION EXHIBITS AT THE COLUMBIAN EXPOSITION."

Sir: In the review of "Transportation Exhibits at the World's Columbian Exposition," in your issue of Nov. 21, you state that H. V. Holmes is the agent in this country. Will you kindly correct this, and say that we are the publishers of this book in this country, and that H. V. Holmes is the Chicago agent.

Yours truly, John Wiley & Sons.

New York city, Nov. 22, 1895.

STICKING PAPER TO METAL OR GLASS.

Sir: I have found that ordinary carpenter's glue of the best quality, to which a little glycerine has been added, will unite paper to metals or glass very successfully. It is quite essential that the metal surface should be clean and entirely free from oxide, oil or dust, otherwise the paper will not adhere. It is comparatively easy, therefore, to cement paper to glass, as the surface of glass is easily cleaned. Sufficient glycerine should be added to make the glue somewhat flexible when dried in thin sheets. Horace Andrews.

Albany, N. Y., Nov. 10, 1895.

CAR WHEEL TESTS AT THE GRIFFIN MACHINE WORKS.

Sir: We have noticed your report of our wheel tests in your issue of Nov. 14, and beg to thank you for same. We desire to call your attention, however, to the error in our title given in the heading of the tabulated list, which reads "Griffin Foundry & Machine Co.," instead of the New York Car Wheel Works and the P. H. Griffin Machine Works. As there are other foundries operated under the name of Griffin, we trust it will not be asking too much for you to make correction of this in your next issue, and we would also call your attention to the fact that there is one error in the statement, caused by a misprint in the newspaper copy which we sent you. In test No. 3, by Austrian State Railway specifications, on a 30-in. spoke wheel, the weight of wheel should have been 500 lbs. instead of 950 lbs., the figures having been transposed. As you will note, the correction makes the showing in our favor, and quite remarkable.

Yours truly, New York Car Wheel Works.
Chas. V. Slocum, Treas.

Buffalo, N. Y., Nov. 25, 1895.

LONGITUDINAL ANGLE STIFFENERS FOR CHORDS OF PLATE GIRDERS.

Sir: We take the liberty of writing you concerning the matter of stiffening the chords of plate girders by riveting angle irons along the cover plates, which you mentioned in your issue of Oct. 24, in your review of "Plate Girder Railway Bridges," by Mr. Fitzmaurice, and concerning which a letter from Walter R. Marden, of Pittsburg, was published in your issue of Nov. 21. This method of stiffening the top flanges of both highway and railway plate-girder bridges has been adopted by this company whenever we considered that the occasion demanded it, and we always use the same method in stiffening the girders composing the runways for heavy traveling cranes.

Yours truly, J. H. Edwards.
Berlin Iron Bridge Co.

East Berlin, Conn., Nov. 22, 1895.

Sir: The editorial note following the correspondence of Mr. Walter R. Marden, in your issue of Nov. 21, seems to call for information of any railway plate girders in this country where angles are put along the outer edges of wide-top flanges. There are a number of such girders on the line of the New York, New Haven & Hartford R. R., among which are those over James St., New Haven (built in 1884), and Asylum St., Hartford (built in 1888). There are also several bridges on the same road where 15-in. channels have been used instead of the first flange plate, as at Sargeant St. (built in 1885), and Cabot St., Holyoke, Mass. (built in 1887), and Mamaroneck Ave., Mamaroneck, N. Y. (1888), and Westchester Ave., Port Chester, N. Y. (1888).

Herbert C. Keith.

New Haven, Conn., Nov. 22, 1895.

ELECTRIC CARS ON STEAM RAILWAYS.

Sir: Referring to the matter of railways operated by both steam and electricity, as mentioned in your issue of Oct. 24, the Coronado Ry. Co. has a section of track on Orange Ave., in this city, which is so operated. The Orange Ave. line is about 1½ miles in length, and extends across the island (Coronado) from the ferry slip on San Diego Bay to the Hotel del Coronado, on the ocean front. The regular service is by the ordinary trolley car, current being supplied by the power plant of the San Diego Electric Ry. Co., by means of a cable laid across the bay for this purpose. This line has been operated by electricity since about Oct. 1, 1893, the service previous to that time having been by steam motor. There is an occasional freight service, which is by steam motor. Connection is made near the ferry slip with the Bay Belt Line, and there are two branches leaving the Orange Ave. line at different points, one about ½ mile long to a racetrack, and the other about three miles to the Zuninga Shoals jetty, now being built by the United States at the mouth of San Diego Bay. These lines are operated by steam power, using that part of the Orange Ave. line between junction points. The Bay Belt Line runs around the head of San Diego Bay, its total length being about 22 miles, and the termini in Coronado and San Diego being nearly opposite, and less than a mile apart.

Respectfully, Geo. H. Tinker.

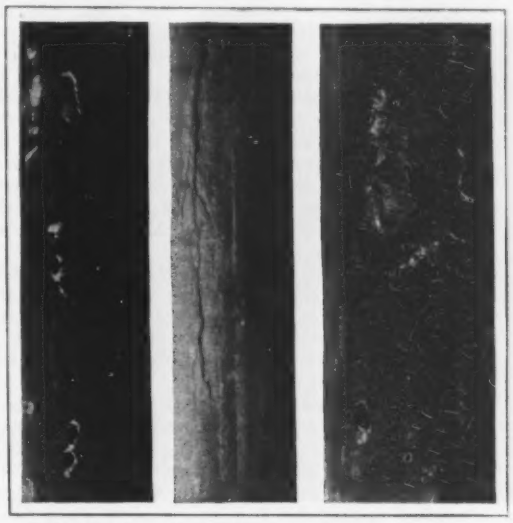
Coronado, Cal., Nov. 13, 1895.

DEFECTIVE CAST IRON COLUMNS IN THE NEW CITY HALL, ST. LOUIS, MO.

Sir: The writer, while recently in St. Louis, took occasion to visit the new City Hall building in process of construction there, and was so impressed by the defects in some of the cast iron columns supporting heavy walls and floors, that he took photographs of some of the worst, copies of which he sends you herewith. These defects were brought to light by the very thorough examination of that building now being made by Mr. Carl Gayler, M. Am. Soc. C. E., City Engineer of Bridges, and Mr. A. H. Zeller, Jun. M. Am. Soc. C. E., Engineer to the Board of Public Improvements. The holes in the columns had been plugged with lead, etc., in some places held by screws, as shown in one column. The writer does not believe these columns, as bad as they look, are much worse than many other cast columns which, without proper inspection in the foundry, go into buildings. It would be impossible for such defective columns to pass the inspection of a competent and reliable inspector.

Yours truly, T. L. Condron,
Western Representative, Pittsburg Testing Laboratory, Ltd.

Chicago, Ill., Nov. 15, 1895.



Defective Cast Iron Columns in New City Hall, St. Louis, Mo.

(Three of the photographs sent by our correspondent are reproduced herewith. The illustrations show the defects so plainly that comment upon them is needless. We noted the investigation of the St. Louis City Hall in our issue of Oct. 31. The Board of Public Improvements of St. Louis is now investigating to determine who is responsible for these defective columns.—Ed.)

STAMPING TITLES ON TRACINGS.

Sir: In my paper last year on "The Relation of the Drawing Office to the Shop in Manufacturing," read before the American Society of Mechanical Engineers, I referred incidentally to a method of stamping titles and numbers on tracings so that they could be blueprinted and give good results. I have received so many inquiries asking for information as to this that it may be of interest to your readers to state how it is done. It is well known, by those who have tried the experiment, that it is difficult to obtain a satisfactory ink that can be used with stamps on tracing linen. Stencils are unsatisfactory, as they are coarse and give broken letters, and are not always black. Printer's ink will not answer, because, although it gives a clean impression, it does not dry on tracing linen, and soon smears and rubs off. After some experimenting, we obtained a special lithographic ink, which, when used with the addition of a "siccative" or dryer, will give clean, black impressions, equal to type printing, and will dry in a short time and be permanent. This result is obtained at the cost of some little care, but the results are good. We use metallic stamps of type metal or brass, with removable type for the numbers. The ink is rubbed up on a palette each time it is used, and applied to the stamps by a composition roller similar to that used for printers' ink, care being taken that only a small amount of ink is used. After the impressions are made, the stamps must be carefully cleaned each time with benzine, as the ink will soon dry and clog the stamps if this is not done. It is our practice to place the number and title in the lower right hand corner of every tracing, and when a roll of tracing cloth is received it is cut up into standard sheets and all stamped and laid away flat in a drawer ready for use, the name of the drawing being filled in by hand in the blank space of the stamp. I enclose you herewith a sample impression of the stamps, and will be glad to send a sample to any of your readers who are interested in the matter. The ink and stamps complete can be obtained from F. D. Hake, 450 East Water St., Milwaukee, Wis. Yours truly,

A. W. Robinson, M. Am. Soc. C. E.
Engineer, Bucyrus Steam Shovel & Dredge Co.

South Milwaukee, Wis., Nov. 13, 1895.

REPLACING TRESTLES WITH EARTHWORK; CANADIAN PACIFIC RY.

Since the completion of the Canadian Pacific Ry. a considerable amount of reconstruction and the replacing of temporary by permanent work has had to be executed, and this reconstruction work was taken by Mr. P. Alex. Peterson, Chief Engineer of the Canadian Pacific Ry., as the subject of his address as retiring President of the Canadian Society of Civil Engineers in January last. The temporary work was purposely adopted in order to hasten the completion of the line and the opening of communication, and this method of carrying out the work enabled the company to open the line five years earlier than it could otherwise have done, besides saving a considerable amount of money in first cost and interest and in ultimate cost, and enabling the company to earn $20,000,000 in the year fixed for the completion of the contract with the government. The temporary work consisted principally of long and high wooden trestles, small pile trestles and wooden truss bridges of 30 to 180 ft. span on pile or crib substructures.

From this very interesting address we take the following particulars respecting the filling in of solid banks to replace wooden trestles, which is a character of work that is continually being carried on more or less extensively on many railways in the United States.

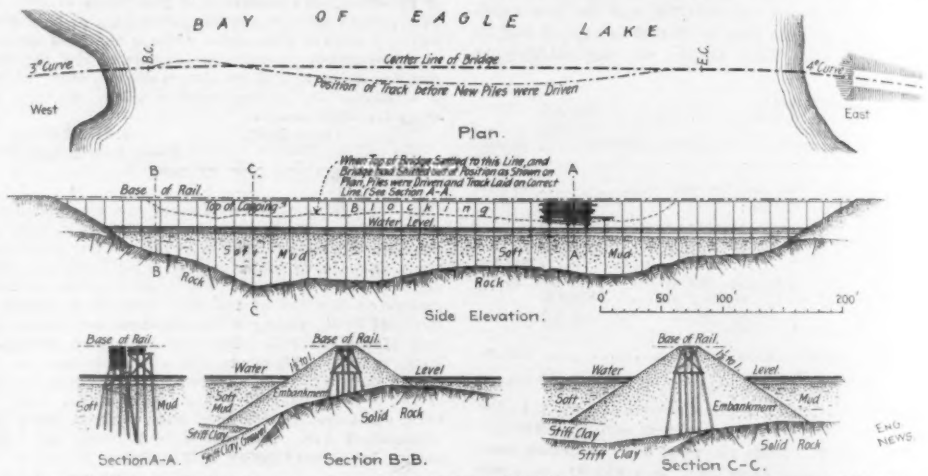
On the Eastern Division alone of the C. P. Ry. there have been filled 535 trestles, aggregating 86,138 ft. in length, and requiring 4,092,612 cu. yds. of material for filling, on which the saving to the company by filling at this time instead of in the original construction has amounted to about $4,095,612. In some cases, where trestles had been built on sloping rock, it was necessary to change the alinement rather than run the risk of stopping traffic. In many instances a certain amount of risk had to be run, and timber was kept ready to repair the track, but in no case was traffic interrupted for more than a few hours at one time. In some places the government had put in quantities of cross-logging, at great expense, but when the banks were filled in this gave way in the middle, forming a blunt edge, which induced sliding on rock bottom or penetration of the crust of soft bottom. Cross-logging is only considered to be of use when a low bank is to be carried on soft material which is not quite able to sustain the load.

The following is extracted from Mr. Peterson's address:

Trestle No. 226 A, 1,248 miles west of Montreal, was a pile trestle 335 ft. long and 8 ft. high, crossing a soft spot in a swamp. Had the bottom been firm, only 2,880 cu. yds. of filling would have been required, but soundings were taken through black muck and soft clay for 60 ft. without finding a hard bottom. When 6,912 cu. yds. (or 864 carloads) had been put in, the track dropped 4 ft. on the whole line of the trestle. Filling was continued, but when 54,000 cu. yds. in all had been put in, the filling sank faster than it could be put in, the banks at each end of the trestle had gone down with the settling, and the track was below grade for 800 ft., the lowest place being 11 ft. below sub-grade. The settlement took place by sudden drops of from 6 to 7 ft., but the place was kept passable by cutting down the track on each side of the lowest point (as the bank never fell more than 11 ft. below grade, which was the level of the water in the marsh), and by filling in with sawdust, so as to enable the heavy wheat traffic to be carried over without assistance from a pusher. The track was raised to within 6 ft. of grade, and the approaches cut down so as to make 2% grades, over which the ordinary traffic passed without difficulty. During the winter the sawdust filling gave no trouble, so in the spring it was decided to complete the bank to within a foot of the required height, and to cover it with a foot of gravel. The sawdust proved so satisfactory that it was decided to raise it 3 ft. higher than the original trestle, in order to improve the grade at this point. The bank as filled has not shown any appreciable settlement, and has remained in perfect order.

Trestle No. 169, 1,250 miles from Montreal, was a pile trestle 596 ft. long and 9 ft. high, built across a swamp, where soundings, or rather borings, were taken for 60 ft. in depth without finding hard bottom. Sawdust having been used with success, as above mentioned, it was decided to try filling this trestle altogether with sawdust, and to spread the weight out as much as possible by using flat slopes of 3 to 1. The sawdust was brought from Keewatin in box cars, containing 45 cu. yds., by freight trains each day, the cars being filled by shoots leading from the mills, and left on a siding near by, to be dumped by a special work gang. The time required to fill the trestle was about three months. The sawdust was covered with a foot of ballast, and has remained in perfect condition, except 75 ft. of the track, which required lifting and tamping for the first three months, probably due to the fact that the sawdust was thrown in loosely and not packed as at No. 226 A. It has since showed no signs of settlement and has given good satisfaction. The quantity of sawdust used was very little in excess of the quantity calculated from the cross-section, showing that sawdust shrinks less than earth for a bank of the same dimensions, and it may be interesting to know that the sawdust bank yields less under a passing train than the trestle, and has less spring in it than a muck bank built over a swamp of the same character.

Trestle No. 177, across a bay of Eagle Lake, was 634 ft. long and 23 ft. above the surface of the water, built with frame bents on piles which were driven through very soft mud and clay overlying rock at depths varying from 20 ft. to 40 ft. The rock sloped to the north at the west end and to the south at the east. A thick mattress of logs was, in the original construction by the government, put in between the piles, or the piles were driven between them for the purpose of assisting to support the bank and to stiffen the piles, standing as they were in such very soft mud.



FILLING IN TRESTLE No. 177 (WESTERN DIVISION), CANADIAN PACIFIC RAILWAY. (BUILT IN 1879; FILLED IN 1893).

Fearing that the mattress, which extended about 50 ft. on each side of the trestle, in settling at the center and turning up at the ends, would slide on the bottom and so wreck the trestle, it was decided to cut the mattress just outside the piles, as the simplest method of avoiding the danger likely to arise from the presence of the cross-logging on such a very soft bottom. This cutting was done from the ice during the winter. Filling was hauled by horses and scrapers to the edge of the cross-logging left between the piles, and dumped over the ends of it, so as to form two banks, or walls, outside of the trestle, to make as much as possible of the bank, with the least interference with the trestle. In spite of this precaution, the trestle sank 2 ft. in one day, when 1,284 carloads had been put in, and went out to the south about 4 ft., and continued sinking and going out of line steadily till, when 4,674 cars, or 37,392 cu. yds., had been put in and hauled out by horses and scrapers, the bridge had settled 18 ft., and was 12 ft. out of line. It had been kept passable all this time by blocking up over the caps, as shown in the accompanying cut. Piles were then driven to the northward on the old line, and the track placed in its original position. Filling was commenced again, and when 7,201 cars had been put in the new piles were as much out of line and had sunk as much as the old bridge had a month previous, and had, of course, during this time to be kept blocked up to keep the bridge open for the heavy wheat traffic. Filling was then stopped for the season, new piles were again driven and the track moved over into line. What remained of the old bridge was now 38 ft. out of line. During the winter and up to May, 1893, no more than 2 ft. of settlement took place. Filling was recommenced on May 2, and by May 9, 866 cars had been put in, when the bridge sank an average of 8 ft. over 28 bents. On May 10 the track was passable, and passenger train No. 2 crossed on time. On May 10 and 11, 305 cars were put in, and at 6 p. m. on May 11 the bridge sank an average of 8 ft. over 18 bents, but though it rained heavily all night, the track was passable at 9 the next morning.

On May 16, when 371 more cars had been put in, the trestle again sank about 8 ft. over the same 18 bents, and went out of line 10 ft. to the south; but the track was blocked up, and made passable by 1 a. m. of the 17th, and all trains passed on time. Between May 17 and 20, 544 more cars, or 4,352 cu. yds., were put in, when the trestle sank again about 8 ft. over the same 18 bents at 1 p. m.; track was, however, passable at 8 p. m. on the same day.

At 5 p. m. on May 23, when 442 more cars, or 3,536 cu. yds., had been put in, the trestle sank about 7 ft. over the same 18 bents, and went out 10 ft. to the south; but by 11 p. m. on the same day it was ready to pass trains, requiring something less than one hour to raise it each foot over the 240 ft. By May 25, 374 more cars had been put in, when the trestle sank for the sixth time 7 ft. over the same 18 bents, causing a stoppage of the line at this point for seven hours. On May 27, after 284 more cars, or 2,272 cu. yds., had been put in, this bank was within 6 ft. of the grade, and by cutting down the approaches it was possible to lay the track on the filling. This was done, and the filling stopped, so as to allow the bank to set and solidify. Work commenced again on Aug. 21, and between that date and Sept. 9, 788 cars were unloaded in small quantities at a time, and the bank brought up to grade 18 ft. wide at base of rail. By July 31, 1894, the embankment settled about 2½ ft. at the lowest point when 96 cars were unloaded, which brought the track up to grade and bank 16 ft. wide at base of rail. Since that date no appreciable settlement has taken place.

The filling of the trestle has been given in considerable detail in order to give a clear idea of the difficulties that are encountered in filling on a bad bottom and sloping foundation, and to show what can be done in the way of keeping such a structure passable in the face of such difficulties, caused by the sudden sliding out into the lake of the original bottom of clay and mud overlying the hard bottom, and carrying with it the filling which rested upon it. The track sank in the autumn of 1892, 40 ft., and in May, 1893, 52 ft., besides smaller settlements that were going on all the time, and yet traffic was maintained, the greatest detention to any passenger train being eight hours, when the track sank at 6 p. m. during a heavy rain, and was ready to pass the train at 9 a. m. next morning. The estimated quantity of filling required for the trestle was 100,000 cu. yds. The total quantity put in was 96,000 yds., which cost $41,637.

When the foundations are good, the filling of a large trestle is attended with little or no risk. Settlements of trestles on apparently good foundation, however, occur, which are difficult to account for, such as that at Big Pic, where, after the trestle had been filled some time, the bank and trestle subsided 6 ft. in one night, and, as far as could be seen, no disturbance of the surrounding ground took place, nor has any further settlement taken place in the past five years. Between Winnipeg and Donald, a distance of 1,024 miles, there are not many large trestles. A few of the large ones west of the summit of the Rockies have been filled, the policy adopted being to fill long, shallow ones, and so to reduce the length of wooden floors as much as possible with the least amount of money, except in certain cases where transfers could not be made or diversions readily built. West of the summit most of the trestles filled were situated on sides of hills, and required retaining walls to hold the banks and prevent the slopes from running down into the Kicking Horse River.

From Savonas to Port Moody, a distance of 213 miles, built by the government, a large amount of work has been done, 27,746 ft. of trestles having been filled. In all cases the streams are carried through the banks in stone arches, or box culverts, and where grasshopper trestles were built, and no drainage required, and there was no room to extend the slopes on account of the steepness of the banks, stone retaining walls were constructed, and generally filled in behind with stone debris. In many cases the sites of the trestles were changed and thrown into the banks, so as to take out curves, and, at the same time, enable the filling to be made without building expensive retaining walls. This has been carefully studied and economically carried out, the line having been thrown in just enough to furnish filling for the trestles, and thus material was obtained close at hand, and the quantity required was reduced by throwing the fills up the hillside, and placing more of the track on solid ground.

The material used in filling trestles on the Eastern and Western divisions was loaded with steam shovels on flat cars, and unloaded by means of the ordinary ballast plow, drawn over the length of the train by the locomotive. On the Pacific Division a large portion of the work was done in the same manner. Where the filling was on side hill, a one-sided, or side hill, plow was used, and on straight track worked fairly well, but on sharp curves it caused a great deal of delay, and very materially increased the cost of the filling. In order to overcome this, all the various dump cars in use were examined in the latter part of 1891, and inquiries made from the principal manufacturers of cars and the leading railway companies and contractors in the United States, when it was found that there was not in use in any place a dump car that would answer the purpose—viz., one that could be unloaded without sending men along the track over the high trestles to do the work, which would have been slow and dangerous. In order to avoid this, the question of operating dump cars by power obtained from the locomotive, using either steam or compressed air, was then considered, when it was found that a plan for using compressed air had been patented in the United States, but had not been put into use. From this design as a basis, and after a number of important changes had been made on it in the Canadian Pacific Ry. Co.'s car department, 50 cars were built in the company's car shops in the spring of 1892, and sent to the Pacific Division, where they gave the most complete satisfaction, trains of 20 cars being regularly unloaded and brought back into position ready to return in half a minute, which, of course, very materially reduced the cost of the filling. This, it is believed, is the first instance where dump cars on railway works have been unloaded by means of compressed air.

Two large embankments, one containing 66,000 yds. and the other 144,000 yds., have been made by sluicing gravel from adjoining hills. The first embankment was filled at a cost of $5,839, of which $2,862 was for labor and the balance was for plant and material used in boxes, etc. The iron pipes, monitors and part of the material in the boxes can be used again, and in fact were used at the second embankment, so it was considered fair to charge only 20% of the plant against the cost of filling, which reduced the total cost to $4,715, or 7.15 cts. per cu. yd. In the second embankment the water was taken from the stream, which runs down the valley that has to be filled, at a point about 584 ft. up the hillside, and 353 ft. above grade, or at an elevation of 125 ft. above the pit from which the gravel is taken for filling the ravine. The water was carried in a 15-in. pipe to a giant or monitor, such as is used in hydraulic mining. This monitor is generally worked with a 5-in. nozzle, and throws a powerful stream against the gravel bank, washing the gravel and boulders down into a flume which has a grade of from 11.5 to 25%. This stream will carry down on to the dump 750 cu. yds. in 10 hours. One man is required to work the monitor, another is at head of sluice, and two along the sluice to start and keep moving boulders that can pass down the flume, but are liable to lodge on a flat side, and three men are required to direct the material as it comes from the flume and to put in brush at the outer edges, so as to prevent the water from cutting channels in the slopes. Old ties taken out of track have been used for this purpose most successfully, by simply placing them on the outer edges of the bank, and when the gravel is raised up to the top of them, a new row is laid down on the lines of the slopes, and so on, new lines of ties being put in for each 6-in. rise of the bank. There are a number of places on the line where this method of filling is to be adopted.

STANDARD HIGHWAY BRIDGE OF STEEL RAILS; BALTIMORE & OHIO R. R.

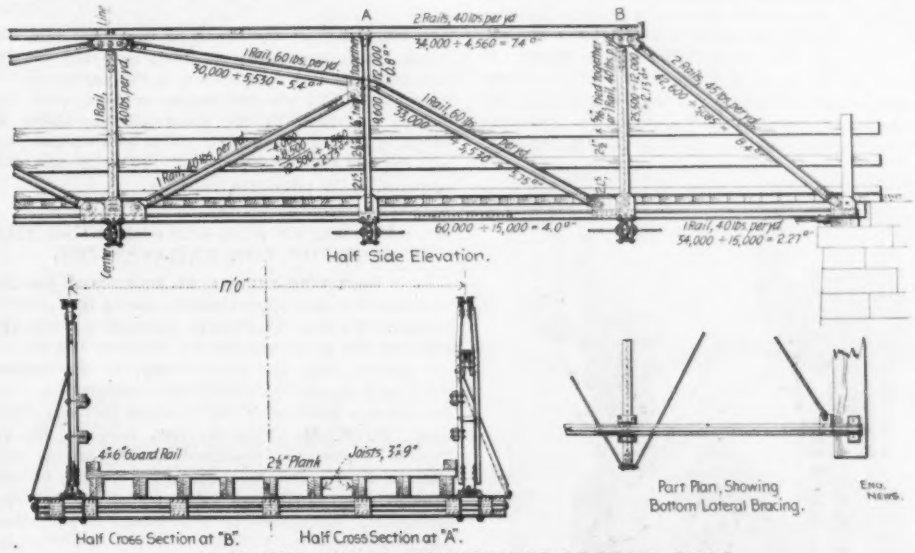
We illustrate herewith a highway bridge constructed of steel rails, which has been patented by Mr. J. E. Greiner, M. Am. Soc. C. E., Engineer of Bridges, Baltimore & Ohio R. R., and has been adopted by that company as its standard for country-road bridges built over its tracks. The general character of the construction and design is so clearly shown by the drawings that no description is necessary. These bridges are designed according to the following specifications for loads, stresses and materials:

Width of roadway in clear	16 ft.
Live load per running ft.	1,200 lbs.
" " concentrated on four wheels	10,000 "

Unit Stresses.

Tensile, steel rails	15,000 "
" angle hangers	12,000 "
Compressive, hinged at each end	$\frac{12{,}000}{1 + \frac{l^2}{18{,}000\ r^2}}$
Compressive, flat at each end	$\frac{12{,}000}{1 + \frac{l^2}{36{,}000\ r^2}}$
Shearing on bolts, pins and rivets	11,250 lbs.
Bearing on bolts, pins and rivets	22,500 "
Bending on pins	22,500 "
" on I-beam floor beams	16,000 "
" on white pine joists	1,200 "
" on yellow pine joists	1,500 "

Material.—Structural material shall be soft or medium steel. Steel rails which have been taken out of the track, on account of wearing of heads, can be used in construction of these bridges, provided their net sectional area is not less than is required by the above unit stresses, and that they are straightened, and are free from cracks or injurious splinters.


A
B
2 Rails, 40 lbs. per yd
34,000 ÷ 4,560 = 7.4"
1 Rail, 60 lbs. per yd
30,000 ÷ 5,530 = 5.4"
1 Rail, 40 lbs. per yd
2 Rails, 45 lbs. per yd
1 Rail, 40 lbs. per yd
60,000 ÷ 15,000 = 4.0"
54,000 ÷ 15,000 = 2.27"
Half Side Elevation.
17'0"
4"x6" Guard Rail
2½" Plank
Joists, 3'x9"
Half Cross Section at "B".
Half Cross Section at "A".
Part Plan, Showing Bottom Lateral Bracing.
ENG. NEWS.

HIGHWAY BRIDGE CONSTRUCTED OF STEEL RAILS.
Designed by J. E. Greiner, M. Am. Soc. C. E.

In designing compression members, Mr. Greiner considers that the rails are hinged about the axis normal to the webs, and square about the axis parallel with the webs of the rails, and when the two rails are used, and connected simply by short tie plates, they are treated as two independent columns, and not as one. The drawing also shows the stresses in each member of a 72-ft. truss, with the loading specified above. For spans under 67 ft., Mr. Greiner states that single rails can be used throughout.

We learn that bridges of this type have met the approval of a committee which was appointed by the General Manager of the Baltimore & Ohio R. R. to investigate the behavior of these bridges in service, and they have been adopted as the standard highway bridge for overhead crossings of country roads, as stated above. It is stated that when the full value of all material used is charged, the cost of these rail bridges is less than the lowest prices for which the company has been able to let contracts for wooden bridges designed to carry the same loads.

THE USE OF MACHINERY IN IRON AND STEEL WORKS.

In the editorial on "Recent Progress in Iron and Steel Manufacture" in our issue of Oct. 24, especial attention was called to the revolution that is taking place in the industry of the United States by the substitution of machinery for manual labor. A similar revolution is in progress in Europe, and in Germany especially it is progressing so rapidly as seriously to threaten the position of England in the trade. A delegation organized by the British Iron Trades Association to inquire into the condition and methods of iron and steel manufacture in Germany and Belgium has recently published some particulars of its observations, from which we abstract the following:

What the British delegates saw and learnt abroad was a revelation to them. The foreigners are, it seems, considerably ahead of us in machinery, while the workmen are better paid and better cared for.

At large works, consisting of blast furnaces, steel works, engineering works, etc., it was found that they were using ore costing 42 cts. per ton at the mines—which is less than the royalty rent. This ore contained 38% of iron. In the blast-furnace department the highest wage paid to men was 90 cts. per day, and women received 40 cts. At each furnace 12 men and five women were employed charging and filling, the duty of the women being to fill coke and train it to the furnace. The average cost of labor was 25 cts. per ton of pig iron, but this did not include extra labor, managers, foremen, etc., and the output per furnace was 80 tons per day. At these works all the engines of every description and every piece of machinery were made on the premises. After going through the sheet mill of a German works, one of the delegates (an employer) said: "We were specially struck with the splendid finish of the sheets. . . . As practical men we could not have believed in the probability of rolling sheets so thin with so good a surface, and with practically no waste. We were more than surprised, both at the mode of working and at the sheets produced, and we could not have believed it possible for such splendid results with so little labor. It would be absolutely impossible to produce sheets in such a quantity and of such an appearance with the appliances we have at our disposal."

Another delegate, a gentleman connected with the best works in sheets in the Midlands, said: "The mode of procedure that is carried on there is so different from anything I have seen carried on in Staffordshire that it will revolutionize the whole mode of working the sheets. We shall have to begin and learn again."

Another works visited employed 2,700 men. One of the delegates says in reference to these works: "I was astounded. Mechanical figures in a miniature Bessemer plant could not have worked more systematically than these men do, and every man seemed to do his work without an effort. The appliances were so that they moved about like a set of figures, and every man knew his place. There was no crowding or hurrying, and in the mills I never saw work done like it in my life. . . . At these works they neither spare money nor time. They have taken time to work out everything that was necessary to improve the machinery, and they have spent money freely." And with all this improved machinery the works are paying the best of any in Germany. For the last 15 years they have paid 25 to 30%.

THE HIGHEST RAILWAY IN THE WORLD.

The Central Railway of Peru reaches the highest altitude of any railway in the world. It crosses the Andes at an altitude of 15,666 ft. above sea level, and two other summits on the southern system of the Peruvian railways reach altitudes above 14,200 ft. These roads were built by the Peruvian Government for the development of the country and for military purposes, and the routes and standards of gages, etc., were fixed accordingly. The maximum grade is 4%, compensated on curves of less than 1,968 ft. radius, and the minimum radius allowed was 393.6 ft.

The Ferrocarril Central del Peru was finished early in 1893 between Callao and Oroya, a distance of 136.5 miles. The Galera tunnel, at

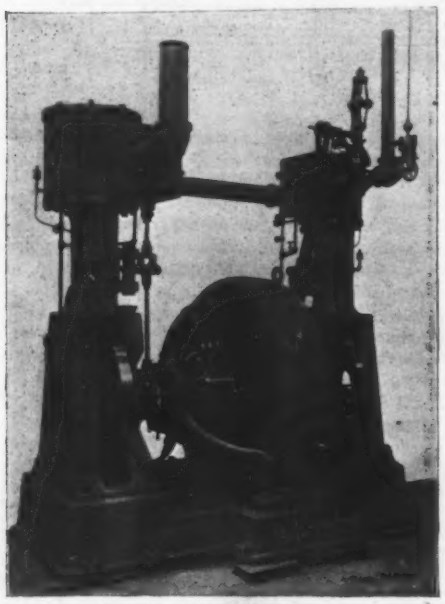
the summit, is 106.2 miles from Callao, and the difference in level between these two points is 15,656 ft. Oroya is 30.2 miles to the east of the tunnel and about 3,300 ft. lower. This road is worked by eight switchbacks, the largest being at Chicla, where a rise of 700 ft. is made. The 56 tunnels are all on the western slope of the mountain, except the Galera, or summit tunnel. Seven of these tunnels are over 12,000 ft. above sea-level, and nine tunnels are more than 15,000 ft. above the sea. The Galera tunnel is 3,654 ft. long, and is one of the few tunnels on a tangent.

The silver mines of Cerro de Pasco are over 14,000 ft. above the sea, and the smelting works of Casapalca, the largest in Peru, are 13,700 ft. above sea-level, and are reached by two short spur lines from the Central Railway. The mines in the Casapalca district are 15,000 ft., and some further east are 17,000 ft. above tide.

We take the above facts from an interesting paper in the October number of the "Engineering Magazine," by Mr. Jas. R. Maxwell, who was for some time engaged as an engineer upon this interesting railway.

THE LANE & BODLEY THROTTLING COMPOUND ENGINE.

The accompanying illustration shows an interesting form of compound engine for electric lighting purposes, which is exhibited at the Atlanta Exposition by the Lane & Bodley Co., of Cincinnati. It consists of two vertical engines of ordinary form, set on one bed plate, with the electric generator between them, the engine shaft carrying the armature of the generator. Both engines have ordinary slide



The Lane & Bodley Throttling Compound Engine.

valves, and the smaller one is fitted with a Pickering throttling governor. The engine is run non-condensing, and it is claimed that, for a non-condensing engine running under variable loads, the throttling governor gives a higher economy of steam than the automatic cut-off governor. With the latter, when running with light loads, the steam being cut off very early in the high-pressure cylinder, initial condensation causes a loss of steam, and in the low-pressure cylinder expansion is carried below the atmosphere, making a loop in the indicator diagram, which shows a loss of useful work. These disadvantages are avoided in the compound throttling engine, in which the cut-off is constant. In the engine at the Exposition the cylinders are 10 and 16 ins. diam., and 12 ins. stroke. At a speed of 275 revolutions per minute, and a steam pressure at the stop valve of 115 lbs., the engine is rated at 90 HP. Special features of the engine are the flywheel cranks, shown in the cut, and the means provided for easy removal of the crank-shaft, with its flywheels and the electric generator, from the frame of the engine, for inspection and repairs. The main pillow blocks are contained in recesses in the inner sides of the upright frames, and the two covers being removed, and the two connecting rods uncoupled, either at the crank or the wrist pin, the crank shaft, generator, etc., can be lifted out by means of the ring bolt shown in the casing of the generator. The electric generator used with the engine was built by the Card Electric Motor & Dynamo Co., of Cincinnati, O. It is a six-pole, direct-current machine, rated at 125 volts and 400 amperes, or 50 kilowatts, capacity.

WEATHER TABLE FOR OCTOBER, 1895. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Deg. Fahr.) Average.	Max.	Min.	Range.	Wind. Velocity in miles per hour. Average.	Max.	Direction at time of max. velocity.	Precipitation—rain or melted snow—inches. Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	41.2	67	15	52	9.9	37	NW	0.45	0.22	7
	Portland, Me.	46.2	68	27	41	8.5	32	NW	1.91	1.19	7
	New York, N. Y.	51.0	71	34	37	14.7	48	W	4.04	2.78	6
	Pittsburg, Pa.	49.8	73	27	46	10.7	28	W	1.11	0.57	8
	Chicago, Ill	46.2	71	24	47	17.2	56	SW	0.51	0.38	4
	Omaha, Neb.	50 4	77	17	60	7.5	26	NW	0.07	0.05	2
	St. Paul, Minn.	43.8	73	15	58	8.9	36	NW	0.09	0.04	4
	Duluth, Minn	42.0	70	18	52	10.2	4	NW	0.09	0.04	4
	Bismarck, N. Dak	43.0	84	2	86	10.3	47	NW	0.08	0.08	2
	Average	46.0	73	19	53	10.9	38		0.93	0.58	5
Southern Cities	Washington, D. C.	52.1	74	29	45	7.1	34	NW	1 94	1.30	4
	Louisville, Ky.	53.1	79	26	53	7.5	36	W	0.90	0.46	6
	St. Louis, Mo	53.6	77	30	47	9.4	36	SW	0.23	0.14	3
	Savannah, Ga	66.4	91	46	45	8 2	26	NE	1.11	1.07	3
	Kansas City, Mo	53.2	80	26	54	7.7	33	NW	0.12	0.09	2
	Jacksonville, Fla.	69.7	89	52	37	7.5	26	N	0.58	0.43	4
	Chattanooga, Tenn.	57.2	83	34	49	5.7	27	SW	2.00	1.54	6
	New Orleans, La.	68.6	87	51	35	8.1	30	NW	1.21	1.01	5
	Memphis, Tenn.	58.4	81	37	44	8 0	29	W	2.17	1.22	7
	Palestine, Tex.	64.8	87	43	44	5.4	29	NW	3.73	2.09	5
	Average	59.7	83	38	45	7.5	31		1.40	0 94	4
Western Cities.	Helena, Mont.	47.3	75	25	50	6.1	35	N	0.28	0.18	3
	Port Angeles, Wash	48.4	65	32	33	4.0	24	W	0.15	0.11	3
	San Francisco, Cal	58.8	83	48	35	8.7	36	W	0.11	0.06	4
	Salt Lake City, Utah	54.3	81	32	49	5.3	28	E	0.24	0.19	3
	Santa Fe, N. Mex	49.6	70	27	43	5.5	31	SE	1.75	1.26	6
	Denver, Colo.	50.7	80	21	59	6.7	36	NE	1.13	0.80	4
	Yuma, Ariz.	75.5	99	54	45	5.1	21	W	0.15	0.10	3
	Average	55.0	79	34	45	5.9	30		0.84	0.40	4

AN APPARATUS FOR DETERMINING THE FORM OF THE EXHAUST JET.

In a locomotive running at high speed the jet of exhaust steam approximates closely to a steady stream. To the designer of locomotive draft appliances the form of this jet between the tip of the exhaust pipe and the entrance to the smokestack is a matter of considerable importance. At the October meeting of the Western Railway Club Prof. W. F. M. Goss, M. Am. Soc. M. E., of Purdue University, described a very simple and efficient device for determining the form of the exhaust jet, which has been tested on the experimental locomotive in the laboratory of that institution.

Fig. 1 illustrates the device and the method of using it. The tubes A and A′ are arranged in suitable fittings to slide horizontally across the smokebox, in a line directly over the center of the exhaust pipe. At the inner ends these tubes are curved downward and drawn down to a tube of small diameter, the edges of which are filed away to make them sharp. The stems of these tubes are graduated, so that the zeros come under the pointers D and D′, respectively, when the inside ends of the tube C and C′ are directly over the center of the exhaust pipe. The sum of the readings at D and D′ will therefore always equal the distance the tips C and C′ are apart. The apparatus was further explained by Professor Goss as follows:

The sliding tubes are open at both ends, and through them there is free communication between the smokebox and the outside atmosphere. When not in use, they are drawn outward until the tips C and C′ lie close against the inside of the smokebox. If the locomotive to which they are attached is using steam, there is a constant current of cool air passing through the tubes into the smokebox, the pressure in the latter being less than that of the atmosphere. The capacity of the tubes, however, is much too small to allow the passage of air enough to disturb the draft conditions, but enough goes through to keep the tubes entirely cool.

When an observation is to be taken, the tubes are slipped forward into the smokebox until the tips enter the stream of exhaust steam, a position which in each case is at once made manifest by a reversal of the air current in the tube, by the consequent change in the temperature of the tube, and by a discharge of steam from its outer end. If the correct position is found, the tips of the tubes will be just on the boundary of the jet of exhaust steam. Both tubes having been thus adjusted, the amount which they are displaced from the line E F is read off from the stem at D and D′; the sum of the two readings giving the width of the jet upon the line at which the pipes are fixed. Having this width, the height of the tube tip above the exhaust pipe, and the dimensions of the latter, the form of the jet may be approximately determined.

It will be seen that the apparatus is extremely simple, and that it may be readily used upon the road. Its accuracy depends upon the size of the orifice, and somewhat upon the delicacy of the tube and of the graduations upon it. The tubes used at Purdue are made from ¼-in. steam pipe, and the orifice at the tip is about 3-32 in. diameter. Each tube can be placed with certainty within 0.1 in. of the edge of the steam jet; that is, in a given position of the tube, air will flow into the smokebox, while a movement of less than 0.1 in. will result in a flow of steam out of the tube. This, taken in connection with other related dimensions for the Purdue engine allows a possible maximum error in the measured width of the steam jet along the line in question, of about 2%.

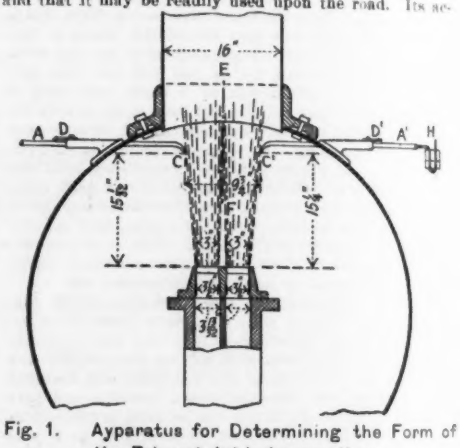


Fig. 1. Apparatus for Determining the Form of the Exhaust Jet in Locomotives.

Designed by Prof. W. F. M. Goss, M. Am. Soc. C. E.

Greater accuracy than this is perhaps unnecessary, but with a view to securing more refined measurements, use has been made of a manometer, consisting of a glass tube bent U-shaped, and sealed with water, attached to the outer end of the sliding tube, as shown at H, Fig. 1. When the tip C′ of this tube is withdrawn from the steam jet, the gage indicates a vacuum; the U-tube becomes a draft gage. But when the tip is thrust into the jet of steam, pressure is indicated. Near the changing point between vacuum and pressure, a small movement of the sliding tube gives considerable change in the reading of the manometer. For limits close about the edge of the steam jet it is fair to assume that a given displacement of the water in the manometer tube always results from a given position of the tip of the sliding tube, relative to the border of the steam jet. Hence, by use of the manometer, readings from the sliding tube may be duplicated with great certainty.

An average result of several measurements made by this apparatus is shown by the dimensions given in Fig. 1. The angle of divergence corresponding to these dimensions is 13¾°. It will be noticed that the experiments were made with a double nozzle.

THE REPORT OF THE NICARAGUA CANAL COMMISSION.

An alleged abstract of the report of the Nicaragua Canal Commission was exclusively published by the New York "Herald" of Nov. 25, and it is here given, in substance, for what it may be worth. According to this abstract, the Commissioners find that new and exhaustive surveys will be necessary before sufficient data will be at hand to make any conclusive estimate and report upon final location, and they give their own conclusions and estimates with this caution. The report practically condemns the present location from Greytown to Brito; or at least suggests very many marked departures from the plan proposed, and increases the cost from the canal company's estimate of $69,893,660 to a "provisional" estimate of $133,472,893. To obtain the necessary data for the finding of a final project, the Commission says that 18 months would be required, covering two dry seasons, and that this investigation would cost about $250,000. The final conclusions are here given as printed in the "Herald":

The entrance to the harbor at Greytown, as proposed by the company, is too near the angle of the coast line, and should be moved eastward about a mile and a half, the present lagoon to be used as the inner harbor and connected with the entrance by a canal with a bottom width of 200 ft. The harbor throughout should be dredged to 30 ft. below low water, and its depth increased to six fathoms at the entrance.

For the canal from Greytown to Lock No. 1.—A bottom width of 100 ft., with a clear depth of 30 ft., and two intermediate and one terminal siding for meeting of vessels is preferable to the company's cross-section of 120 ft. bottom width, 28 ft. depth and no sidings. The location of the canal through the Bernard lagoon is objectionable, and the line may probably be moved to the southward and straightened with advantage.

Lock No. 1 to end of summit level, at Lock No. 3.—To reduce the lift of locks and dams in the Deseado Valley, four locks, with a maximum lift of 28 ft., are preferable to three with a maximum lift of 40 ft., as proposed by the company, particularly in view of the increase of the summit level elevation from 106 to 112 ft. above sea level. The company's cross-section of the canal between locks has a bottom width of 120 ft. The Commission believes that the width of 100 ft., with sidings at proper intervals, should be adopted.

Eastern Divide Cut.—Additional borings on the axis of the cut, and parallel therewith, to cover proposed excavation, are necessary for information as to materials and their distribution. The vertical one-fifth to one slopes, proposed by the company, may have to be increased, and the cube thereby somewhat enlarged.

The proposed basins, from the East Divide along the San Juan River to Ochoa, called the San Francisco basin, involve long lines of very heavy embankments in clay, traversing deep mud bottoms at some points, which will call for great care in construction. The width of the connecting channels, now fixed by the company at 80 ft., should be increased to [illegible] ft., and a depth of 30 ft. provided below elevation 100. The height of all embankments should be raised to provide for a water surface elevation of 112, and the use of any portions of the embankments as weirs is admissible.

Thorough search should be made in the vicinity of the site now proposed for the Ochoa dam, for the most advantageous location for the structure, and the full nature of the foundations and shore line connections be exhaustively ascertained. As proposed by the company, the dam is to be a "rock-fill" across a powerful river, on a sand foundation. A dam so constructed has no precedent, and its erection in conflict with the unknown volume of the floods presents grave difficulties. Its total dimensions and cost cannot be reliably computed with the present data.

A masonry structure would be preferable, if a suitable foundation could be discovered, and its cost not be prohibitory. It is believed that a rock-fill dam could be built after careful study of the physics of the river, and the geology of the site, but in order to do this, and later provide for a due regulation of the water level, it may be expedient to build sufficient sluices in the San Carlos Ridge to relieve the dam while under construction. The use of the dam as a weir is regarded as inadmissible, and its height must be such as to enable the surface level to be maintained at elevation 112, or possibly higher.

If sluices are not constructed in the San Carlos Ridge, capable of diverting the full volume of the river in flood, weirs at suitable points on the crest line will be necessary, and an elaborate system of movable dams, so constructed as to take the full flow, the object being to maintain the water surface elevation at 112 during the dry season or to draw it down to 106 during the rainy season.

The San Juan River, from Ochoa to the lake, should be thoroughly leveled and surveyed throughout, and observations made for at least a calendar year to determine its varying slope, volume and water surface elevation. Full exploration should be made of the river bed, by borings or other suitable means, to determine the materials to be excavated, both for channel improvement and to cut off bends for necessary reduction of curvature.

The channel should have a bottom width of not less than 250 ft., enlarged to 300 and 400 ft. in bends, in lieu of 125 ft. bottom width proposed by the company; and the deepening should be to 30 ft. instead of 28, using a 4-ft. slope, from 112 at the lake to 106 at Ochoa, as the datum plane for determining the depth of excavation.

The area and regimen of Lake Nicaragua should be determined, and the extent and approximate value of the lands that would be overflowed at elevations 112 and 115 ascertained. The excavated channel should have a width of not less than 300 ft., instead of 150, as proposed.

In the western division, which comprises the territory from Lake Nicaragua to Brito, the Pacific terminus of the canal, what is known as Lake to Brito.—The Lajas-Rio Grande route is preferred to any other that has been examined. The information with reference to the site of the proposed La Flor dam indicates that its construction and maintenance are inadvisable, as an alternative low-level route is entirely practicable. This may follow either the right or the left bank of the Rio Grande from the head of the valley.

A dam should be built in the valley which would constitute the western limit of the summit level. The southern, or left bank, of the route should be fully located and bored, to determine its relative merit. It has the advantage of avoiding complication with the discharge from the Tola watershed, and the disadvantage of requiring more diversions of the Rio Grande River. The number of locks in the western division can be advantageously increased to five, with a less maximum lift than the three locks proposed by the company. The lift of the lock nearest the sea should have the least lift.

Brito Harbor, the company's western terminus of the canal on the Pacific.—The borings and other considerations indicate the desirability of moving the entrance of the harbor southeastward from the point proposed by the company, and a very considerable extension of the breakwater is required for the adequate projection of the entrance.

All locks should have a width of not less than 80 ft. if the navigation be intended to provide for the passage of war vessels.

All streams affecting the canal route should be gaged to ascertain their regimen.

Rainfall observations should be made at consecutive points over the entire route from Greytown to Brito.

Full exploration for alternative routes in the eastern division should be made, to include the so-called low level line by the company on the left bank of the San Juan to the San Manillo, and thence to Greytown, and, more particularly, full investigation should be made as to the practicability of extending the canalization of the river to the vicinity of the Serapiqui by means of comparatively low dams.

The official estimate by the company of $69,393,660 is insufficient for the work. In several important cases the quantities must be greatly increased, and in numerous cases the unit prices do not make proper allowance for the difference in cost of work between the United States and Nicaragua.

It should be understood that the existing data are inadequate as a basis for estimating the cost of many structures; some portions of the work may cost more, others less.

For obtaining the necessary data for the forming of a final project 18 months' time, covering two dry seasons, and an expenditure of $250,000, will be required.

Next in importance to the conclusions of the Commission, says the "Herald," are its estimates of the cost of construction of the project and the comparison of these figures with those fixed by the Canal company. Very elaborate tables are submitted comparing the Commission's estimates of quantities and unit prices with those of the company as corrected to 1895. A comparative recapitulation of the cost is thus given:

	Company's estimate.	Board's estimate.
Eastern division	$31,399,844	$51,306,295
Lake and river division	5,922,785	26,234,343
Western division	20,549,091	28,186,773
Lights and buoys	373,000	500,000
Management and engineering	.....	4,000,000
Hospital service	.....	1,000,000
Totals	$58,244,717	$111,227,411
Contingencies, 20%	11,648,943	22,255,842
Grand totals	$69,893,660	$133,472,893

The "Herald" states that the report contains, in addition to the essential features already given, the letter of transmittal accompanying the report upon its submission to the President through the Department of State; description and present condition of Greytown harbor, the eastern divide, the San Francisco basin, the Ochoa dam, the San Juan River, Ochoa to Lake Nicaragua, Lake Nicaragua. Lake Nicaragua to Brito and Brito harbor. It also contains a general physical description of the country, a history of the project and a detailed account of the additional surveys and examinations deemed necessary by the Commission to arrive at a decision regarding the feasibility, permanence and cost of the project.

The repaving of streets is a subject of discussion between the electric railway companies and the City Works Commissioner of Brooklyn, N. Y. The city has brought suit against the company to compel the payment of the amount expended in laying new granite block paving between the tracks, but the company claims that this is unreasonable, as electric cars do not cause any wear of the pavement, and save much of the cost of street cleaning which was required when horse traction was employed.

The competitive trials or horseless carriages now being arranged for by "The Engineer," of London, call for a run of not less than 100 miles out and 100 miles back, and no speed over 10 miles an hour will be taken into account, as this is considered to be sufficient for all practical purposes. Any method of propulsion by mechanical power contained in the carriage may be employed. No oil used for an explosive mixture, vapor or fuel must have a lower specific gravity than 0.8, or a lower flashing point than 73° F. (Abel's test). Under the existing laws no adequate competitive trials can take place, but a modification of the laws at the next session of Parliament is confidently expected. The judges will be Sir Frederick Bramwell, M. Inst. C. E.; Mr. John A. F. Aspinall, M. Inst. C. E., Chief Mechanical Engineer of the Lancashire & Yorkshire Ry., and Dr. John Hopkinson, M. Inst. C. E. The competing carriages will be divided into classes, with prizes as follows: (a) Carrying four or more persons and weighing (loaded) not more than two tons, $1,838; (b) carrying one, two or three person, and weighing (loaded) not more than one ton, $1,311; (c) carrying one ton of freight or parcels and weighing not more than two tons, $1,311; (d) carrying 560 lbs. or less of freight or parcels and weighing not more than one ton, $790.

Work on the new double-deck railway and highway bridge across the MississippiRiver, at Rock Island, Ill., has been commenced. This bridge will be 1,845 ft. long, consisting of two 258-ft. spans, three 216-ft. 6¾-in. spans, one 193-ft. 3-in. span, one 98-ft. 9-in. span, and one 365-ft. 7-ins. swing span, and is being built jointly by the U. S. Government, which pays 60% of the cost, and the Chicago, Rock Island & Pacific Ry., which pays 40% of the cost. It will extend from the island of Rock Island to the west bank of the river, and will replace the bridge now in use, occupying the same piers and abutments, which will be widened for a double-track structure. The total weight of ironwork is 5,000 tons. The trusses will be placed 29 ft. apart c. to c., and the lower deck will carry a 26-ft. roadway and two 6-ft. sidewalks, and the upper deck will carry a double-track railway. The sidewalks will rest on brackets outside of the trusses, and the clearance between the two decks is about 12 ft. The upper deck for the railway will have a solid floor of Pennsylvania Steel Co.'s trough sections. The swing span will weigh 2,600,000 lbs., and will be operated by electric power. Mr. Ralph Modjeski, Assoc. M. Am. Soc. C. E., Chicago, Ill., is the Chief Engineer in charge and the designer of the bridge, and Col. A. R. Buffington, U. S. Engineer Corps, Rock Island Arsenal, represents the U. S. Government. The contractors for the work are the Phoenix Bridge Co., Phoenixville, Pa., and they have sublet the contract for the substructure to Sooysmith & Co., of New York, N. Y., and for the electric operating machinery to Geo. P. Nichols & Co., of Chicago.

Bids for constructing the regulating works for the west end of the Chicago Drainage Canal were received Nov. 20 from eight different firms. The general character and extent of these works were described in our issue of Nov. 21, and in our Construction News Supplement this week the names of the different firms and the prices bid are given in detail. As designs and plans for parts of the work were called for in connection with the bids, these plans will all have to be carefully studied in order to select the best, before any contract will be let. In studying the prices on another page, therefore, it must be remembered that the lowest lump bid does not necessarily indicate the successful contractor.

The New York & New Jersey Bridge Co. has elected a new board of directors, as follows: Gen. James S. Clarkson, Des Moines, Iowa; John S. Runnells, general counsel of the Pullman Company, Chicago, Ill.; William J. Latta, Philadelphia, Pa.; Hon. Daniel N. Lockwood, Buffalo, N. Y.; Louis Windmuller, New York; Frederick Potter, Potter Building, New York; Charles A. Smylie, New York; William Bell, Produce Exchange, New York; William H. Ely, New York; Lorenzo Duncan, Brooklyn; John Loughran, President Manufacturers' Bank, Brooklyn; Charles H. Swan, Brooklyn, and John C. Adams, Newburg, N. Y. At the annual meeting President Clarkson reported progress, with general plans approved by the Secretary of War, but the detail plans cannot be completed until the question of the location of the approaches is settled by concurrent action of the U. S. Government and the state and city authorities of New York.

The new East River bridge, according to the report of the committee appointed to advise as to traffic facilities, should have an extreme width of 118 ft., providing for two footways, two carriageways, and a railway system of four or six tracks.

The Niagara Falls Hydraulic Power & Manufacturing Company's proposition to increase the capacity of its canal is declared illegal by Attorney-General Hancock, of New York state. The channel in question was excavated in 1850, and it is 70 ft. wide by 14 ft. deep, running from Port Day, about one mile above the falls, through a strip of land 100 ft. wide, to the mills on the edge of the chasm. This canal has been acquired by the Niagara Falls Hydraulic Power & Manufacturing Co., and has a present capacity of about 200,000 gallons per minute. Mr. Hancock contends that the Niagara Reservation was created for the purpose of preserving this great natural waterfall and its environments for the enjoyment of the people of the state. The legislature has devoted the water in the Niagara River to public use in creating this Reservation, and as the flow over the falls is an essential feature in this public use, its further diversion for industrial purposes through the canal of the company named has a diminishing effect upon the flow over the falls and the diversion can be restrained.

Philadelphia's harbor is to be further improved by extending the city piers, and an ordinance providing for a 3½% loan of $2,000,000 has been recommended by the Finance Committee of the City Councils. The government work of dredging and the removal of Smith's and Windmill islands is nearing completion, and the city bulkheads should now be extended to the new Port Warden's line. The estimated cost of doing this work is $2,000,000, of which the Girard estate would provide $600,000 in accordance with the will of Stephen Girard. The government has expended $2,404,000 out of the estimate of $3,500,000 for removing 21,500,000 cu. yds. of material from the harbor.

The foundation for the lock at the Herr's Island dam, on the Ohio River, near Pittsburg, is about completed. The bottom of the foundation is about 30 ft. below low-water mark. Hoffman and Cumberland cement were used for the concrete, which was mixed in two cubical mixers, dumping into small barges. Work on the dam itself will not begin till further appropriations are available.

An offer to keep in repair the asphalt pavements of Binghamton, N. Y., for 4.8 cts. per sq. yd. has been made by the Warren-Scharf Asphalt Co. The offer covers streets paved by this company on which the guarantees for repairs have expired. The low price of 2 cts. per sq. yd. for these repairs is also offered in case that all sprinkling on these streets be stopped and that the street railway company shall repair around its tracks at its own expense.

The old Mississippi & Mexican Gulf Canal is to be extended and deepened, and provided with locks, so as to connect Lake Borgne with the Mississippi River above New Orleans. At least, this is the purpose of a syndicate of Northern capitalists, and the object is to admit stern-wheel steamers and barges from the river to the lake and on to Mobile. The transport of lumber and coal to points east of New Orleans would be facilitated, and the rehandling of this traffic by railways would be avoided.

The fluctuations in the level of Lake Michigan have been accurately observed by the U. S. Engineers at Milwaukee since 1859. These records show that from 1860 to 1864 the level was falling towards the normal; from 1864 to 1874, the level was below the average, except in 1870-71; from 1874 to 1888, the level was, on the whole, above the average, or normal; and from 1888 to the present time the lake has been below its normal level. The inference is that from climatic causes alone there are somewhat regular periods, or oscillations, in the lake level, and the fact that the rainfall in this region for the 10 years past has been below the normal agrees with this assumption.

Owing to low water in Lake Erie, State Engineer Adams reports that the water in the Ohio Basin, at Buffalo is 3 ft. below normal level, containing 6 ft. in some places, instead of 9 ft. Mr. Adams believes it would be a wise precaution to cut 3 ft. out of the present canal bottom between Buffalo and Lockport, both to provide against a recurrence of the present low level in the lake, and because a greater volume of water will be needed in the canal after the proposed enlargement is completed. The low water in Lake Erie is due to entirely natural causes, and the flow over Niagara Falls is less than ever before, except in the case of heavy storms sweeping the water to the westward.

The floating derrick "Monarch," recently built by the Chapman Wrecking Co., is capable of lifting 200 tons dead weight, or 700 tons under water. The "Monarch" is 150 ft. long by 50 ft. beam, and has a derrick frame 92 ft. high, with a boom 98 ft. long. There are three vertical engines for hoisting purposes and trimming, and one horizontal engine. The hoisting fall is a 2-in. steel wire rope, and the main fall blocks have each six sheaves, and weigh over two tons. A 10-in. pump is used for pumping out water from a wreck. The "Monarch" cost $80,000, and she was first used in successfully lifting a dredge sunk near Black Ledge, off New London, Conn.

The ram "Katahdin" will probably be accepted by the government on the recommendation of Secretary of the Navy Herbert. With the exception of some minor deficiencies, to be made good by the builders, she is reported as fulfilling all the contract conditions, except in speed and weight of machinery. The sum of $57,454 will be deducted from the contract price for the lack of speed and excess of machinery weight. An excess weight of 41 tons in the machinery is due to changes ordered by the department; the excess due to the work of the builders upon which the penalty is imposed is only about 8 tons. The contract speed was 17 knots; but the mean speed actually obtained on the trial was only 16.11 knots. The "Katahdin" has now fitted upon her 775 tons of armor supplied by the government at a cost of $423,562.08, an average cost of $546.53 per ton; hence rejection of the vessel under the terms of the contract would involve a heavy loss to the government, as this armor would be practically useless elsewhere. The penalty on machinery excess weight is $4,330.

The Hudson River boat "Adirondack," last week launched for the People's Line, to run between New York and Albany, will cost about $1,000,000 when complete. The boat is 387 ft. long, or 400 ft. over all, 50 ft. beam, and 12½ ft. depth of hull, with a draft of 7½ ft. The engines will be of 8,000 I. HP., driving side wheels 34 ft. diameter. The boat was built by John Englis & Son, of Greenpoint.

The American merchant marine, on June 30, 1895, numbered 23,240 documented vessels of 4,635,960 tons, according to the annual report of Eugene F. Chamberlain, Chief of the Bureau of Navigation. This is a decrease of 50,000 tons in the year, attributable to business inactivity two years ago. Mr. Chamberlain recommends the repeal of many antiquated laws which other maritime nations have long ago abolished, and which now handicap our merchant marine. He again recommends a free ship bill, permitting Americans to buy ships where they please. As showing the present competition with other nations, he says that last year the voyage between the United States and Europe was made only 252 times under the American flag, and 10,233 times under foreign flags. In the event that a free ship bill is not passed at this session, Mr. Chamberlain suggests an extension of the act under which the "New York" and "Paris" were admitted to American register, and the "St. Louis" and "St. Paul" were built in this country. He advises the abolition of compulsory pilotage on the coasting vessels in the 10 states from Maryland to Texas, as this law discriminates against American vessels, and in favor of foreign steamers.

The Fire Island lighthouse is not to be abolished, as is currently reported in the daily press. It will still be maintained, though a lightship will be stationed six miles to the south of Fire Island, as stated in our issue of Nov. 21.

Prizes amounting to $5,000 are offered by the Commissioners for the Erection of Public Buildings, in Philadelphia, for the decoration of the Common Council Chamber in the new City Hall. This sum is to cover the cost of a competition for sketches for mural and other decorations. The city will furnish blueprints showing the space to be decorated, and the competition is open to American artists of any age or sex. The best design will be awarded $3,000; the second, $1,000, and a third, $750. Applications for plans, rules, etc., should be made to W. Bleddyn Powell, architect, 459 City Hall, Philadelphia, Pa.

An ordinance restricting the height of business and office buildings in San Francisco, Cal., to 125 ft., has been vetoed by Mayor Sutro, as defective in its wording and provisions. But it is stated that it will be passed over the veto and then amended in the faulty parts.

An engineering census of 386 alumni of the College of Civil Engineering of Cornell University has been made by Director E. A. Fuertes. He divides all who have graduated from this college since its foundation into 7 groups. In the first group of 118 alumni, 8 are presidents of railways, 8 are presidents of industrial corporations, 17 are city engineers, 35 are engineers in practice, 5 are consulting engineers, 9 are contractors, and 37 are chief engineers, managers, or superintendents of bridge companies, railways, water-works, etc., manufacturing establishments and organized corporations. Of the second group of 37 alumni, 22 are professors in colleges and the rest are associate professors or instructors. In the third, fourth and fifth groups of 111 in all, nearly all are assistant chiefs or assistant engineers. In the sixth group of 52 alumni, one-half are mining, mechanical, or electrical engineers; the others are architects, shipbuilders, patent lawyers, or are in the service of foreign governments. In the seventh and last group of 22 alumni are clergymen, merchants, bankers, a judge, a physician, and 2 "politicians." Of the 45 alumni not accounted for above, 28 have died and 17 had not been heard from when the census was made. The record is a goodly one, and most creditable to Cornell.

Traffic across the British Channel, between Dover and Calais, was interrupted for over two days by the fierce gales of Nov. 23, 24, 25. Hundreds of persons are said to have been assembled at Calais waiting for an opportunity to cross. This is another and strong argument for the construction of a tunnel. Actual tests prove this construction to be feasible and of reasonable cost, but it is objected to by the English for trivial political reasons.

The floating tower of light at the Atlanta exposition attracts perhaps more attention than any other electrical exhibit, and, as far as novelty is concerned, it probably deserves the place of honor. The structure is moored on the Clara Meer, not far from the electric fountains, and is connected with a generator on shore by a 700-ft. cable. Its shifting lights across the water of the little inland lake produce a peculiar and pretty effect.

The estimated product of gold and silver in the United States for the calendar year 1894, says the Director of the Mint in his last report, was 1,910,813 fine ounces of gold, valued at $39,500,000, and 49,500,000 fine ounces of silver, valued at $31,422,000 commercially, and of the coining value of $64,000,000. The estimated product of the world for the same year was as follows: Gold, 8,737,788 fine ounces, valued at $180,626,100; silver, 167,752,565 fine ounces, of the commercial value of $106,522,900, and of coining value of $216,892,200. The estimated metallic stock in the United States, on July 1, 1895, was, gold, $636,229,825; silver, $625,853,940; total, $1,262,083,774. Mr. Preston estimates that the principal countries of the world hold, approximately, $4,086,800,000 in gold, $3,439,300,000 in full legal tender silver, and $631,200,000 in limited legal tender silver. The uncovered notes are placed at $2,469,500,000. The value of gold and silver used in the industrial arts in 1894 is estimated at $21,541,652, of which $10,658,604 was gold and $10,893,048 was silver. The report does not locate this use in the arts.

The "arpent" or French acre, still found in old surveys in Detroit and other sections originally settled by Frenchmen, says Mr. Thomas Campau, in a paper read before the Michigan Engineering Society, was employed as follows: It was used as a lineal measure, as well as a measure of surface. It was made up of 180 French feet, the proportion to an English foot being as 1.0 to 1,068 ft. In measuring, a pole was employed which was 18 French feet long; and this measure is still used by the descendants of some of the old French settlers as our surveyors use a "rod." The "arpent" varies in different localities, and the U. S. Commissioners appointed to investigate private land claims, after carefully investigating the subject, concluded that the "arpent" used in the vicinity of Detroit was equivalent to 192.24 English feet.

Streets of curved alinement have been proposed by Mr. Frederick Law Olmstead for certain sections of Washington, D. C., where the rugged topography forbids straight streets. Mr. Olmstead has laid down in this way streets of gentle slope and of architectural beauty, though there was strenuous objection to the curvatures from some of the citizens interested. These streets come into the section of the city west of Rock Creek, and, it is to be supposed, include sections of isolated houses, though solidly-built blocks could be easily adapted to the curved street formation.

CONTENTS OF SUPPLEMENT.

PERSONALS..... 173
ENGINEERING SOCIETIES..... 173
Coming Technical Meetings..... 173
NEW PUBLICATIONS..... 174
Trade Publications..... 174
CONSTRUCTION NEWS:
List of Contracts Pending..... 174
Railways..... 175
Street and Electric Railways..... 175
Electric Light and Power..... 176
Bridges..... 176
Buildings..... 177
Water-Works..... 177
Irrigation..... 178
Sewerage..... 178
Garbage Disposal..... 178
Streets and Roads..... 178
Manufacturing Plants..... 178
Contract Prices..... 179
Miscellaneous Contracts and Supplies..... 179
Metal Market Prices..... 180
INDUSTRIAL NOTES..... 180

PERSONALS.

(Readers are requested to contribute items of interest for publication in this column.)

Mr. C. F. Varnum has been elected Superintendent of Buildings of Lowell, Mass.

Mr. B. H. Beasley has been elected to the Board of Public Works of Nashville, Tenn.

Mr. W. B. Sparks has resigned his position as General Manager of the Georgia Southern & Florida Ry.

Mr. N. H. Foster has been appointed Manager's Assistant of the Pacific System lines of the Southern Pacific Ry.

Mr. Robert C. Pruyn, of Albany, has resigned from the vice-presidency and directorship of the Ulster & Delaware R. R.

Mr. Wilson Bray, the originator of refrigerating systems as applied to ocean steamers, died at Lambertville, N. J., on Nov. 23.

Mr. John C. Kauffman, who was identified with the iron manufacturing industry in eastern Pennsylvania for 65 years, died at Leesport, Pa., on Nov. 20.

Mr. C. E. Schaff, formerly Assistant General Manager of the Cleveland, Cincinnati, Chicago & St. Louis Ry., has been made General Manager of that road.

Messrs. F. R. Coudert, W. H. Geishenen and George Sherman have been appointed by the Supreme Court of New York state as commissioners to examine the plans of the Rapid Transit Commission, of New York city.

Mr. C. C. Elwell, formerly Roadmaster of the New York Division of the New York, New Haven & Hartford, has been appointed Superintendent of the Norwich Division of the New England R. R., with headquarters at Norwich, Conn.

Mr. Aldace F. Walker, Receiver of the Santa Fe system, has been elected Chairman of the Board of Directors of the newly-organized company. Mr. Walker's services as Receiver have been so satisfactory that the reorganization committee has thus expressed its desire to retain him at the head of affairs.

Mr. Robert E. Peary, C. E., U. S. N., the well-known Arctic explorer, has reported for duty again as a civil engineer at the Navy Yard in Brooklyn. Mr. Peary says that he does not contemplate any further Arctic explorations, for the present at least. In the last four years he has expended about $60,000 in his several expeditions.

Mr. Patrick Stirling, M. Inst. C. E., Locomotive Superintendent of the Great Northern Ry., of England, since 1866, died recently, at the age of 75. He was especially noted for the design of the express type of locomotive with a single pair of 8-ft. driving wheels, and a four-wheel leading truck which has been used on that road for 25 years.

Mr. Leonard Forbes Beckwith, educated in Paris as a civil engineer, and once Engineer of the New York Subway Commisson, died on Nov. 18, at a private asylum in Bronxville, aged 52 years. Mr. Beckwith was the brother of the artist, Arthur Beckwith, and with him inherited a large estate from their father, Mr. Nelson M. Beckwith, formerly President of the Mutual Fire Insurance Co., of New York.

Mr. F. D. Banister, M. Inst. C. E., Chief Engineer of the London, Brighton & South Coast Ry., of England, has resigned his position (which he has held since 1860) on account of ill health, and the company has granted him a pension of $5,000 per year. He was born in 1823, and began his railway career in 1844 in the location of the East Lancashire Ry., and entered the service of what is now the L., B. & S. C. Ry., in 1846.

Mr. Francis Collingwood has just delivered the second of a course of three lectures to the students of the Engineering School of the University of the City of New York, on the subject of foundations. A similar course on the subject of bridges will be shortly delivered to the members of the senior class by Mr. Alfred P. Boller, M. Am. Soc. C. E., to be followed by three lectures on the subject of water-works construction by E. Wegemann, Jr., M. Am. Soc. C. E.

Mr. Horace L. Eaton, City Engineer of Somerville, Mass., committed suicide by shooting, Nov. 23. It is thought that the deed was the result of temporary insanity, occasioned by worry incident to the investigation by the city council of charges of dishonesty brought against him. Mr. Eaton was known to be a man of the highest principles and an able engineer. It is a matter of the greatest regret that his morbid sensitiveness should have prompted this unfortunate act.

Mr. E. P. Ripley has been chosen President of the new Atchison, Topeka & Santa Fe R. R. Co. by the joint reorganization committee, which recently convened in New York city. Mr. Ripley's experience as a railway manager has been very extensive, and his thorough acquaintance with all phases of railway operation makes him pre-eminently fitted to wield executive power. Since 1890, Mr. Ripley has been Third Vice-President of the Chicago, Milwaukee & St. Paul Ry. He will assume his new position about Dec. 15.

Mr. Calvert Vaux, the well-known landscape architect, of New York, met his death by drowning in Gravesend Bay, Long Island, Nov. 19. Mr. Vaux was born in London, England, Dec. 20, 1824. After his preliminary education he studied under a London architect, but in 1848 came to this country and became associated with Andrew J. Downing in landscape architecture. Together they laid out the grounds surrounding the Capitol and the Smithsonian Institution in Washington. Mr. Vaux's reputation has been acquired mainly through his work in New York city. Acting with Frederick Law Olmstead, he laid out Central Park. Prospect Park, in Brooklyn, is also a product of his genius. Later he was associated with Mr. Olmstead in designing parks in Chicago and Buffalo, in laying out Riverside and Morningside parks in New York, and the State Reservation at Niagara Falls.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec. 2. Secy., G. L. Annan, City Engineer's Office.
ENGINEERING SOCIETY OF WESTERN NEW YORK.
Dec. 2. Secy., Geo. B. Sikes, 122 Pearl St., Buffalo, N. Y.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3-6. Secy. F. R. Hutton 12 W. 31st St. New York.
COLUMBIAN ENGINEERING SOCIETY.
Dec. 3. Secy., W. F. Hart, University Bldg., 15th and H Sts. N. W., Washington, D. C.
WESTERN SOCIETY OF ENGINEERS.
Dec. 4. Secy., Chas. J. Roney, Monadnock Block, Chicago.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 4. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 4. "Tests of Fireproof Flooring," by George Hill.
Secy., C. W. Hunt, 127 E. 23d St., New York.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 5. Secy., C. H. McLeod, Montreal.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 6. Secy., O. H. von Geldern, 819 Market St., San Francisco.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 7. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF KANSAS CITY.
Dec. 9. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 10. Secy., F. A. Colburn, Case Library Building.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 10. Secy., H. Breen, 36 Jacobson Block.
NORTHWEST RAILWAY CLUB.
Dec. 10. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.
NORTHWESTERN SOCIETY OF ENGINEERS.
Dec. 10. D. W. McMorris, Burke Bldg., Seattle, Wash.
WISCONSIN POLYTECHNIC SOCIETY.
Dec. 10. Secy., W. K. Means, Loan & Trust Bldg., Milwaukee.
NEW ENGLAND RAILROAD CLUB.
Dec. 11. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 12. Secy., Lucius P. Brown, Nashville, Tenn.
ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 12. Secy., Jas. K. Zollinger, Norton Building.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.
INDIANAPOLIS ENGINEERING CLUB.
Dec. 14. Secy., C. C. Brown.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Dec. 14. Secy., Forrest J. Smith, Denver Block, Helena.
ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 16. Secy., E. Nexson, Kasota Block.
WESTERN RAILWAY CLUB.
Dec. 17. Secy., W. D. Crosman, Rookery Bldg., Chicago.
ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 18. Secy., F. Van Vleck, Los Angeles, Cal.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Dec. 18. Secy., J. A. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 18. Secy., S. E. Tinkham, City Hall.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Dec. 18. Secy., R. W. Pope, 26 Cortlandt St., New York.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 19. Secy., D. Carhart, Carnegie Library, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 19. Secy., J. F. Wilson, Odd Fellows' Temple.
NEW YORK RAILROAD CLUB.
Dec. 19. Secy., John A. Hill, 256 Broadway, New York.
ENGINEERS' CLUB OF COLUMBUS, O.
Dec. 21. Secy., David Buel.
CENTRAL RAILWAY CLUB.
Jan. 10. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 16. Secy., F. A. Charpiot, Macon, Ga.

ENGINEERS' CLUB OF KANSAS CITY.—At the meeting of Nov. 13, the subject discussed was "How to Abate the Smoke Nuisance." Mr. R. J. McCarty read a carefully-prepared paper on the subject, touching upon the several methods now employed for the abatement of smoke in large cities. An extended discussion followed the paper.

ENGINEERING ASSOCIATION OF THE SOUTH.—On Nov. 14 was held the annual meeing of the Association, at which officers for the ensuing year were elected. Hunter McDonald, Chief Engineer of the Nashville, Chattanooga & St. Louis Ry., was chosen President, and Lucius P. Brown, of Nashville, Secretary. The retiring President, Dr. W. L. Dudley, addressed the members on the subject of technical education.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the regular monthly meeting held in New York on Nov. 20, the programme consisted of a topical discussion of "Storage Battery Application." A series of short papers on different phases of the subject was presented, the subjects being as follows: "The Storage Battery for Central Stations," by Arthur E. Childs; "The Storage Battery or the Gas Engine as an Auxiliary," by Nelson W. Perry; "Use of Storage Batteries in Electric Lighting," by Francis B. Crocker; "Past and Present Obstacles in the Storage Battery Development," by Carl Hering.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the meeting on Nov. 20 written discussions on Mr. Starling's paper on "The Discharge of the Mississippi River" were read by the Secretary. One of the most interesting of these was by Prof. J. B. Johnson, suggesting that the author supplement his paper by some statements as to the effect of building levees along the whole course of the river below Cairo, so that flood discharges will all have to be carried by the main channel, and also as to the effect of shutting off the outlets at the Red and Atchafalaya rivers, thus further increasing the volume to be carried by the main channel. Mr. John Thomson referred to the variations in meter records which would result from using the meters in clear and muddy water, owing to the varying friction of the vanes. Mr. W. B. Price's discussion referred to the Price current meters, which have been described in our columns. A discussion by Mr. A. P. Davis on the paper on "A Water Supply for Placer Mining and a New Style of Dam," was also read, in which Mr. Davis referred to irrigation canals carrying water at high velocity which were lined with an asphalt concrete composed of sand, broken stone and asphalt.

NEW YORK RAILROAD CLUB.—At the annual meeting, held Nov. 21, the subject for discussion was as follows: "Is it Good Policy for a Railway to Manufacture, to any Considerable Extent, in its Own Shops, Articles for Repairs to either Cars or Locomotives that can be Purchased in the Open Market?" Mr. A. E. Mitchell (Erie R. R.) thought that the items of cost of transporting raw material, use of cars, etc., are usually overlooked in estimating the cost of manufacture in railway shops, and he believed that railways should purchase all supplies, except such articles as bolts, which can be made cheaply from rods and broken bolts in the scrap pile. The Erie R. R. closed its foundries five years ago, and when the cost of hauling pig iron, operating the plant and distributing the castings is taken into account. Most railway shops have an equipment of old tools, which are good enough for repair work, but cannot compete with modern tools in rapidity and cheapness of work. Manufacturing shops can afford to put in new and special machines, but railways cannot do this, and it is not advisable that they should.

Mr. Geo. W. West (N. Y., O. & W. Ry.) stated that his road purchases brasses and bolts. Mr. Higgins (Lehigh Valley R. R.) stated that it pays to manufacture large bolts from scrap, but smaller bolts and articles which are made specialties of by manufacturers can be purchased 10 to 40% cheaper than they can be made in the railway shops. Mr. H. H. Vreeland (Metropolitan Traction Co.) stated that in the electric railway business, one reason for taking up manufacture in the railway shops was the high prices originally charged by manufacturers. One company spent $600,000 on a foundry and machine shop for making parts of motors, gear wheels, etc., but has now discontinued the plant, charged it to the profit and loss account, and has still saved several thousand dollars clear by operating it at a time when prices for the articles manufactured were very high. For instance, a trolley wheel which was sold for $3.50 was made at the shops for 75 cts., but is now purchased from a manufacturer for 65 cts. The motor equipment of a car cost about $2,500 per car four years ago, but can now be purchased for $675. The only street railways now doing their own manufacturing are in the West, and far removed from the factories.

Mr. Wattson (West Shore R. R.) believed it a good principle to do a certain amount of manufacturing in the shops, in order to maintain a permanent working force, the force working on the rebuilding of cars and engines during dull times. Of course, in such dull times, railway managements are apt to cut down the shop

forces. But this does not affect the principle. Another member referred to the great extent to which the Grand Trunk Ry. goes into the manufacturing business, making its own wheels, axles, wire, iron and brass castings, etc., but another member stated that if the road had given encouragement to manufacturers, it would now be able to purchase its supplies cheaper than it can manufacture them.

The following officers were elected for the ensuing year: President, Geo. W. West (re-elected); First Vice-President, A. E. Mitchell; Second Vice-President, H. H. Vreeland; Third Vice-President, C. M. Mendenhall; Treasurer, C. A. Smith; Executive Committee, W. C. Ennis, W. G. Wattson and W. W. Snow; Finance Committee, F. M. Patrick, R. M. Dixon and D. M. Brady.

NEW PUBLICATIONS.

LOUISIANA SUGAR REPORT. 1894-95. A Boucherean, 325 Camp St., New Orleans, La. Pamphlet; 6×9 ins.; pp. 68.

In this pamphlet are given complete statistics regarding sugar production and producers in the state of Louisiana, during the year September, 1894, to September, 1895. Manufacturers of pumps and other machinery desiring to cultivate the trade of the Louisiana sugar houses will find of great value the detailed list of all the sugar plantations in the state, with the name of the owner, annual product, machinery in use, etc.

SKETCH PORTFOLIO OF RAILROAD STATIONS and Kindred Structures. With Nearly 200 Illustrations, including Drawings by Messrs. H. P. Kirby, E. J. Meeker, Gray Parker, James A. Johnson, Chas. Vanderhoof, George Beekman, F. Colburn, the Author, and Others, from Original Designs by Bradford Lee Gilbert, Architect. 1895. New York: "The Railroad Gazette" publisher. Oblong; 4to.

The title sufficiently indicates the nature of this publication. Its value lies in the reproduction of a large number of elevations and perspective views of railway stations, of varying magnitude and under a great variety of surrounding conditions. General floor plans are not included; but in each case the general dimensions and the materials of construction are stated. The reproductions are beautifully done from original wash and pen drawings by architectural artists of reputation, and the portfolio is invaluable for its suggestions to those engaged in planning structures of this class.

U. S. COAST AND GEODETIC SURVEY. Report of the Superintendent for the year ending June 30, 1893. Part II. Appendices relating to the methods, discussions and results of the coast and geodetic survey. Washington. 8vo; pp. 639; maps and illustrations.

The titles of these appendices are: (1) State laws authorizing entrance upon land for the purposes of the U. S. Coast and Geodetic Survey; (2) heights from geodetic leveling between St. Louis and Jefferson City, Mo.; (3) phototopography in Italy and Canada; (4) photographic determinations of longitude by lunar distances; (5) base line measurements with steel tapes and steel and brass wire; (6) fundamental standards of length and mass; (7) units of electrical measure; (8) historical account of the boundary between Pennsylvania and Delaware; (9) proceedings of the geodetic conference at Washington, D. C., 1894; (10) exhibit of the U. S. Coast and Geodetic Survey at the Chicago Exposition; (11) variations of latitude at San Francisco, Cal.; (12) determination of latitude, gravity and magnetic elements at stations in the Hawaiian Islands, including a result for the mean density of the earth.

BOSTON TRANSIT COMMISSION. First Annual Report, for the Year Ending Aug. 15, 1895. Howard A. Carson, Chief Engineer. Boston, Mass. 8vo; 85 pp.; illustrated.

While this is an official report issued by the Commission, it will be interesting to many of our readers to know that it has been published. The problem of rapid transit is a peculiar one in Boston, and this report describes in all detail the subway now under construction between Pleasant and Causeway Sts., on the Tremont St. route. The act creating the Transit Commission permits it to construct, besides the Tremont St. subway, on which work is now in progress, a double-track railway tunnel from Scollay Square, in Boston, to Maverick Square, East Boston. The report states that, as a result of study and investigations made, the plan outlined promises "fairly" for both moderate cost and usefulness. Including inclines, the tunnel would be 4,775 ft. long, with a double-tube structure, each tube being 12 ft. wide by 16 ft. high. The top of each tube would be 35 ft. or more below low tide. The estimated cost is between $2,225,000 and $2,500,000. Compressed air and a shield would be used in construction. The report is illustrated by plans of route and details of the subway, and by excellent photogravures, showing actual progress on the work.

PROCEEDINGS OF THE LAKE SUPERIOR MINING INSTITUTE: Third Annual Meeting, March, 1895. Published by the Institute, Lansing, Mich. Paper; 6×9 ins.; pp. 93.

The meeting of the Institute here reported was held in the Mesabi iron range, in Minnesota, excursions being made to the mines, and evening sessions being held in Virginia and Tower, two towns of the region. The pamphlet of proceedings contains an account of the "Iron Ranges of Minnesota," by Horace V. Winchell, and the following papers: "Distribution of Phosphorus and System of Sampling," by E. F. Brown; "Efficiencies of Some Pumping Plants on the Menominee Range," by Per Larsson; "The New Pumping Plant of the Stirling Iron & Zinc Co., New Jersey," by J. Parke Channing; "The Hoisting Plant of the Lake Mines," by J. M. Vickers; "The Relation of the Vein at the Central Mine to the Kearsarge Conglomerate," by L. L. Hubbard; "Open-Pit Mining, with Special Reference to the Mesabi Range," by F. W. Denton. A communication on the "Cost of Crushing Hard Hematite" was presented by the Secretary, stating that in a three-months' run of the Minnesota Iron Co., 110,477 tons of ore were passed through the crushers, at a cost per ton for supplies of 4.54 cts., and for all other items, 3.36 cts., making a total of 7.9 cts. per ton of ore. There are two crusher plants, each with a 14×36-in. Reynolds Corliss engine and three 28×30-in. Blake crushers. One engine developed 125 HP. Cast steel has given the best service for wearing faces.

POOR'S DIRECTORY OF RAILWAY OFFICIALS AND MANUAL OF AMERICAN STREET RAILWAYS. Tenth Annual Issue; November, 1895. New York: H. V. & H. W. Poor. Cloth; pp. 700; $3.

The edition of this directory which is just out contains an unusually large amount of valuable information and many new features, including several especially intended to increase the value of the book to investors and bankers. For example, pp. 150 to 172 contain comprehensive tables of dividends paid by railway, traction and industrial companies during 8½ years, date when paid, when declared, time of closing of transfer book and where payable, and also a diary showing the meetings to be held, or the transfer books that are to be closed, on each day of the year 1896. Another new feature is the statements of railway mileage and equipment on pages 471 to 502. The total length of street railway lines in the United States is given as 13,176 miles, an increase of 3,514 miles since 1891, operated as follows: With steam dummies, 409 miles; cable, 579; animal traction, 1,950; electricity, 10,238. The rapid adoption of electricity for street railway service is shown by the fact that, notwithstanding the increase in mileage since 1891, the number of horses employed in street railway service has declined nearly 145,000, or about 71%. The capitalization of street railways is shown to average, per mile, $40,691 of stock and $28,333 of bonds, aggregating $69,024 a mile, against $56,611 for steam roads. All the tables in the directory show a vast amount of labor and care in compilation, and a special effort seems to have been made to guard against reporting "paper" railway projects. We are somewhat surprised to find the editor asking in the Introduction for information as to terminal points, mileage, etc., of such roads as the Burlington & Hinesburg, when this information has been published several times in the Construction News columns of Engineering News, and the president and projector of the road has offices in this city only a short distance from those of the publishers of this directory.

UNIVERSAL DIRECTORY OF RAILWAY OFFICIALS, 1895. Compiled from Official Sources. Directory Publishing Co., 8 Catherine St., Strand, London, England. 8vo; cloth; pp. 343; 10 shillings ($2.50).

This is probably the most complete and comprehensive directory of officials of railways in all parts of the world that has ever been prepared, and it gives not only the names of (in most cases) the principal and many minor officers, but also the length (always reduced to miles), the gage, and the number of locomotives, passenger cars and freight cars. The railways of England, Europe and the British colonies are treated very fully. Among the omissions and inaccuracies (which are inevitable in a book of this kind) may be noted the omission of the Panama Ry. and Cartagena & Magdalena Ry., of Colombia (which are owned by American companies), and the failure to note that the Jamaica Ry. is now owned by an American company. The state railways of Brazil are also very incompletely treated, only one or two officers being mentioned, and the location of the office not being stated. Of Mexican railways, also, some are omitted, including the Mexican Southern Ry., with 227 miles. In addition to this, the railways of Nicaragua, Guatemala, Ecuador, etc., are omitted altogether, and, in fact, "Poor's Directory" (the well-known American publication) gives more complete information respecting Central and South American railways. One of the weakest points, however, appears to be in the list of United States railways. About 100 lines have been selected, but apparently without much system, owing largely, no doubt, to lack of knowledge as to the status and importance of the different lines. Thus the list includes several such small lines, or lines of minor importance, as the Cincinnati, Saginaw & Mackinaw (59 miles), Norfolk & Southern (113 miles), Toledo, Saginaw & Muskegon (95 miles), Bangor & Aroostook (230 miles), etc., while the omissions include such great systems as the Chicago, Rock Island & Pacific (3,571 miles), Missouri Pacific (5,378 miles), Louisville & Nashville (4,831 miles), Norfolk & Western (1,570 miles), and Maine Central (823 miles). The book is an excellent directory of the railways in the Eastern Hemisphere. It is printed on good paper and strongly bound, after the manner of English books of this class.

TRADE PUBLICATIONS.

APPLICATION OF PAINTS, VARNISHES AND ENAMELS FOR THE PROTECTION OF IRON AND STEEL STRUCTURES AND HYDRAULIC WORK. Edward Smith & Co., 45 Broadway, New York city. Pamphlet; 6×9 ins.; pp. 40.

This publication contains a thorough discussion of preservative paints for iron and steel, embracing a paper read by Prof. A. H. Sabin before the New England Railroad Club, and extracts from two papers read before the American Society of Civil Engineers, with an abstract of the discussion following the same. The compilation of these papers forms a valuable contribution to the literature of the subject.

SLEEPING CAR.—Lockwood Stateroom Sleeping Car Co., Telegraph Building, Cincinnati, O. Paper; 10¼×7 ins.; pp. 16; illustrated.

This car is of the "compartment" type, with a corridor along one side, but its special feature is that at night each passenger has a stateroom to himself, the partitions folding in such a way that the upper berth is in one compartment and the lower berth in another. Doors connect the staterooms with each other, and with the corridor. The berths are transverse to the axis of the car. Each stateroom is 4 ft. wide by day and 5 ft. 8 ins. wide by night, and has a sofa berth 6 ft. 6½ ins. long by 1 ft. 6¼ ins. wide, and toilet arrangements. A 72-ft. car will have 14 single-berth compartments, one double-berth compartment and two ordinary berths. The privacy attained by this arrangement is certainly an advantage over cars of the ordinary style.

DISK WATER METERS. By O. Iben, Hamburg. Reprint of an Article from the "Journal fuer Gasbeleuchtung und Wasserversorgung." 8vo; paper; pp. 11; two diagrams. Apply to the Neptune Meter Co., 253 Broadway, New York city.

This is a translation of a brief article on the above subject. The author presents the results of tests for sensitiveness and loss of head in three American disk meters, the Bee, Nash and Trident, manufactured respectively by the Thomson Meter Co., of Brooklyn; the National Meter Co., of New York, and the Neptune Meter Co., of New York. A table and diagrams present the results of the tests, one of the diagrams affording a comparison between the loss of head in the American meters named and six types of foreign meters. The author states that from the results of the tests it appears that the disk water meters far excel the rotary vane meters in regard to accuracy of registration. The pamphlet concludes with some comments on the article by Mr. John Thomson, M. Am. Soc. C. E., Vice-President and Engineer of the Thomson Meter Co.

FROGS, SWITCHES, CROSSINGS, ETC.—The Weir Frog Co., Cincinnati, O. Cloth; 8¾×5 ins.; oblong; pp. 273; illustrated.

This is the 1896 edition of the company's catalogue, and is in the familiar standard style adopted in all its catalogues. The book is enlarged by the addition of new material and illustrations of new designs. It contains several different patterns of stiff and spring-rail frogs, split and slip switches, crossings for steam, cable and electric railway tracks, high and low switch-stands, semaphore signals, the Latimer bridge-guard, rail braces for street and steam railways, and various other devices. Among the specialties for street railway work are sharp curves and turnouts, and a derailing switch for electric railways crossing steam railway tracks, the switch being closed by a lever on the opposite side of the crossing, so that the car conductor must go over the crossing before the car can pass. There are also several handy diagrams and tables of turnouts, tables of switch timbers, quantities of track material, etc.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Nov. 29.	Street lighting,	Cleveland, O.	Nov. 7
	Advertised, Eng. News, Nov. 7.		
Nov. 29.	Fire engine,	Chetopa, Kan.	Nov. 14
Nov. 29.	School building,	West Hoboken, N. J.	Nov. 14
Nov. 29.	Laying water pipe,	New Orleans, La.	Nov. 21
Nov. 29.	Macadam road,	Killingly, Conn.	Nov. 21
Nov. 29.	Pipe sewers,	Fort Wayne, Ind.	Nov. 21
Nov. 29.	Sewer bonds,	Portsmouth, Va.	Nov. 21
Nov. 29.	Pipe sewers,	Fort Wayne, Ind.	Nov. 21
Nov. 29.	Steel sewer pipe,	Niagara Falls, N. Y.	Nov. 28
Nov. 30.	Water-wks. system,	Bay St. Louis, Miss.	Nov. 14
Nov. 30.	Water-wks. system,	Duquesne, Pa.	Nov. 21
	Advertised, Eng. News, Nov. 21 and 28.		
Nov. 30.	Bridge,	Akron, O.	Nov. 21
Nov. 30.	Sewers,	Akron, O.	Nov. 28
Nov. 30.	Macadam road,	West Hartford, Conn.	Nov. 28
Nov. 30.	Brick paving,	Akron, O.	Nov. 28

Nov. 30. Macadamizing, Alton, Ill.....Nov. 28
Nov. 30. Water bonds ($500,000), Chicago, Ill.....Nov. 28
Nov. 30. Hospital building, Binghamton, N. Y...Nov. 28
Dec. 2. Sewers (22 miles), Mobile, Ala.....Sept. 19
Advertised, Eng. News, Aug. 29 to Oct. 24.
Dec. 2. Brick paving, Cincinnati, O.....Nov. 7
Dec. 2. Artesian wells, Forman, N. Dak.....Nov. 14
Dec. 2. Artesian well bonds, Forman, N. Dak...Nov. 14
Dec. 2. Dredging in Mokelumne River, Cal.....Nov. 14
Dec. 2. Water bonds ($15,000), Newberg, Ore...Nov. 14
Dec. 2. Condenser, McKeesport, Pa.....Nov. 21
Advertised, Eng. News, Nov. 21 and 28.
Dec. 2. Asphalt paving, New York, N. Y.....Nov. 21
Dec. 2. Plans for sewer system, Parnassus, Pa..Nov. 21
Dec. 2. Irrigation bonds ($50,000), Ord, Neb....Nov. 21
Dec. 2. Valves for pump, McKeesport, Pa.....Nov. 21
Advertised, Eng News, Nov. 21 and 28.
Dec. 2. Public lighting, New York, N. Y.....Nov. 21
Dec. 2. Fire engines, Toronto, Ont.....Nov. 21
Dec. 2. Paving, etc. (16,460 sq. yds.), Toledo, O.Nov. 21
Dec. 2. Sewers, New York, N. Y.....Nov. 21
Dec. 2. Fire alarm system, New Orleans, La....Nov. 28
Dec. 2. Street signs (2,500), Jersey City, N. J...Nov. 28
Dec. 2. Sewers, Jersey City, N. J.....Nov. 28
Dec. 2. Addition to police station, Providence..Nov. 28
Dec. 2. Brick paving, New Orleans, La.....Nov. 28
Dec. 2. Brick and pipe sewers, Blue Island, Ill..Nov. 28
Dec. 3. Water-works system, Oxford, O.....Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Dec. 3. Prison work, Philadelphia, Pa.....Nov. 14
Dec. 3. Pipe sewers, Cranford, N. J.....Nov. 21
Advertised, Eng. News, Nov. 21 and 28.
Dec. 3. Artesian well, etc., League Isl. navy y'd.Nov. 21
Dec. 3. Paving, New York, N. Y.....Nov. 21
Dec. 3. Sewers, New York, N. Y.....Nov. 21
Dec. 3. Sewers, Trenton, N. J.....Nov. 21
Dec. 3. Macadam road, Westport, Conn.....Nov. 28
Dec. 3. Public lighting, Pittsburg, Pa.....Nov. 28
Dec. 3. Paving, Philadelphia, Pa.....Nov. 28
Dec. 3. Sewer system, Wildwood, N. J.....Nov. 28
Dec. 4. Approaches U. S. Bldg., Davenport, Ia...Nov. 7
Advertised, Eng. News, Nov. 7 and 14.
Dec. 4. Water bonds, Middletown, Ind.....Nov. 7
Dec. 4. Cast iron pipe, Hawaiian Government..Nov. 21
Advertised, Eng News, Nov. 21 and 28.
Dec. 4. Macadam road, New Brunswick, N. J..Nov. 21
Dec. 4. Artesian well, Mellette, S. Dak.....Nov. 24
Dec. 5. Pump well, etc., Evansville, Ind.....Nov. 14
Advertised, Eng. News, Nov. 14.
Dec. 5. Laying cable in Chile.....Nov. 14
Dec. 5. Water-works system, Middletown, Ind..Nov. 14
Dec. 5. Intake pipes, Evansville, Ind.....Nov. 14
Advertised, Eng. News, Nov. 14.
Dec. 5. Light twr., Portes des Morts Rge., Mich.Nov. 21
Advertised, Eng. News, Nov. 21 and 28.
Dec. 5. Boiler, Jersey City, N. J.....Nov. 21
Dec. 6. Brick sewer, St. Louis, Mo.....Nov. 28
Dec. 6. Heating & Ventilating, Buffalo, N. Y...Nov. 28
Dec. 7. Iron work for movable dams, W. Va....Nov. 14
Advertised, Eng. News, Nov. 14 to 28.
Dec. 7. Improving streets, Clifton, O.....Nov. 21
Dec. 7. Improving ventilating, New York, N. Y..Nov. 28
Dec. 7. Fire engine house, Pittsburg, Pa.....Nov. 28
Dec. 7. Sewer, Evansville, Ind.....Nov. 28
Dec. 7. Iron bridges (3), Salina, Kan.....Nov. 28
Dec. 9. Tunnel, Colorado Springs, Colo.....Nov. 21
Advertised, Eng. News, Nov. 21 to Dec. 5.
Dec. 9. Electric light plant, Cincinnati, O.....Nov. 21
Dec. 9. Gravel road, Rockville, Ind.....Nov. 21
Dec. 9. Iron bridge, Houston, Tex.....Nov. 28
Dec. 9. Gravel road, Brazil, Ind.....Nov. 28
Dec. 10. Garbage disposal, New York, N. Y.....Oct. 31
Dec. 10. Wharfwork at Rimouski, Que.....Nov. 14
Dec. 10. Dredging in Christiana River, Del.....Nov. 14
Advertised, Eng. News, Nov. 14 to Dec. 5.
Dec. 10. Railway station, etc., San Francisco, Cal.Nov. 21
Dec. 10. Iron bridge, Rapid River, Mich.....Nov. 21
Dec. 10. City hall, Tell City, Ind.....Nov. 28
Dec. 11. Pumping engine, Cleveland, O.....Nov. 14
Advertised, Eng. News, Nov. 14 and 21.
Dec. 11. Piling (62,528 ft.), St. Louis, Mo.....Nov. 21
Dec. 11. Iron bridge, New Orleans, La.....Nov. 21
Dec. 11. Electric light plant, Mitchell, Ind.....Nov. 21
Dec. 11. Bridge Superstructure, Toledo, O.....Nov. 21
Dec. 11. Iron bridge, Camden, N. J.....Nov. 28
Dec. 11. Brick paving, Lexington, Ky.....Nov. 28
Dec. 12. Building superstructure, Allegheny, Pa..Nov. 21
Dec. 12. Arc lights (80), Shreveport, La.....Nov. 21
Dec. 12. Water bonds ($60,000), Nevada City, Cal.Nov. 28
Dec. 14. Reservoir, etc., Tarrytown, N. Y.....Nov. 21
Advertised, Eng. News, Nov. 21 to Dec. 12.
Dec. 14. Water-works, Riverside, O. (Cincinnati).Nov. 21
Dec. 14. Steel bridges (2), Denver, Colo.....Nov. 28
Dec. 16. Water-works system, Greenville, Miss..Nov. 14
Advertised, Eng. News, Nov. 14 to Dec. 5.
Dec. 16. Macadamizing, Cincinnati, O.....Nov. 21
Dec. 17. Steel rails (4,000 tons), Ottawa, Ont....Oct. 24
Dec. 17. Light fixtures, Rochester, N. Y.....Nov. 28
Dec. 17. Fireproof shutters, New York, N. Y....Nov. 28
Advertised, Eng. News, Nov. 28 and Dec. 5.
Dec. 18. Water-works, Winton Place, O.....Nov. 21
Dec. 18. Water-works system, Falmouth, Ky.....Nov. 28
Dec. 18. Street cleaning, Cleveland, O.....Nov. 28
Dec. 18. Addition to hospital, Poughkeepsie, N.Y.Nov. 28
Dec. 19. Boiler house, etc., Los Angeles, Cal.....Oct. 31
Dec. 20. Canal (30 miles), Baltimore, Md.....Nov. 28
Advertised, Eng. News, Nov. 28.
Dec. 21. Steel & ironwork for U. S. bldg., N. Y..Nov. 28
Dec. 23. Heating & ventilating, Canton, O.....Nov. 28
Dec. 26. Water supply, Ft. Hall Ind. Res.. Idaho.Nov. 28
Jan. 6. Bridge, Astoria, Ore.....Nov. 21
Jan. 7. Street ry. franchise, New Orleans, La..Oct. 17
Jan. 7. Pumping engine, Red Wing, Minn.....Nov. 28
Jan. 13. Plans for court house, Galveston, Tex..Nov. 21
No date. Test well, Newton, Kan.....Nov. 28

RAILWAYS.

East of Chicago.

ALBANY, HELDERBERG & SCHOHARIE.—Incorporated in New York on Nov. 15 to build a railway from Albany to Schoharie, N. Y., a distance of about 30 miles; capital stock, $300,000; incorporators, J. H. Brooks, B. M. Secor, J. W. Van Valkenburg, R. J. McCauley, all of Albany, and others. The motive power is specified as steam, electricity or compressed air.

BANGOR & AROOSTOOK.—Grading on the 5½-mile extension of the Bangor & Aroostook, from Sherman to Patten, Me., will be completed Dec. 1, and, if possible, rails will be laid before the last of December. One hundred and fifty men are now at work upon the line. Ch. Engr., J. C. Boyd, Patten, Me.

CANTON & EAST LIVERPOOL.—According to press reports, this company, whose incorporation was noted in our issue of Nov. 14, is controlled by the Cleveland, Canton & Southern Ry., which intends to extend its Minerva branch to East Liverpool through Salineville.

FALL BROOK.—It is reported that this company contemplates an extension of its line from Penn Yan to Hammondsport, N. Y., along the shore of Keuka Lake. Ch. Engr., F. J. Hayt, Jr., Corning, N. Y.

LEHIGH VALLEY.—The Greenville & Hudson Ry., whose incorporation was noted in our issue of Nov. 7, is, according to press reports, a Lehigh Valley project to gain access to its yards and docks in Jersey City. At present this company uses the tracks of the National Docks R. R. for 2½ miles through Jersey City, and it is the intention to parallel that line. The line has been located and the right of way secured. It is said that construction will commence at once.

LIMA NORTHERN.—W. B. Strang, Jr., & Co., 15 Wall St., New York, contractors for this road, write us that 20 miles of track will be laid and ballasted by Dec. 1, the present rate of progress being about 1½ miles per day. Forty miles has been graded, and this work will be pushed to complete the second 40 miles by March 1. All tracklaying and ballasting as far as Adrian, Mich., will be finished by April 1.

PITTSBURG & BUTLER.—Incorporated in Pennsylvania, on Nov. 23, to build a railway from Etna, Allegheny county, to Butler county, a distance of 25 miles; capital stock, $250,000; Pres., F. Gwinner; Directors, John D. Nicholson, W. J. Mustin, A. M. Neeper, all of Pittsburg, Pa.

TOLEDO, ANN ARBOR & NORTH MICHIGAN.—The construction of the new short line from Alma to Ithaca, Mich., mentioned in our issue of Oct. 31, has been stopped by an injunction secured by the people of St. Louis, Mich., compelling the road to run all trains through that place. St. Louis is on the old line, and is practically side-tracked by the new. Its citizens claim that a bonus of $30,000 was given to the railway company for its original construction work, with the understanding that the main line was to pass through their city. An interesting legal contest will result.

WASHINGTON COUNTY.—Geo. A. Curran, Pres., Calais, Me., informs us of the present condition of work on this project. The contract for construction is held by Geo. P. Wescott and James Mitchell, of Portland, Me., and work was begun by them on Oct. 1. Surveys are now nearly completed, and eight miles has been graded. The route is 115 miles in length, and extends from Calais to Ellsworth, through Red Beach, Robbinston, Perry, Eastport, Pembroke, Dennysville, Edmunds, Marion, Machias, Whitneyville, Jonesboro, Columbia, Harrington, Cherryfield, Franklin and Millbridge. Ch. Engr., James Mitchell, Machias, Me.

Southern.

BAYOU LAFOURCHE & GULF.—It is reported that the surveys have been nearly completed for this road, which is to connect Donaldsonville with the Southern Pacific. R. W. Edwards, Donaldsonville, La., is the promoter of the enterprise. Ch. Engr., H. M. Stone, Donaldsonville, La.

CHESAPEAKE & OHIO.—A press report from Ashland, Ky., contains the information that this company will extend the branch now terminating at Richardson, Ky., to Johnson City, Tenn. Ch. Engr., H. Frazier, Richmond, Va.

NORTHERN ALABAMA.—R. T. Simpson, Florence, Ala., writes us that the road incorporated in Alabama under the above name, as noted in our issue of Oct. 24, is a reorganization of the Birmingham, Sheffield & Tennessee River, recently sold under foreclosure decree. It has not yet been definitely decided to increase the extent of the line, which at present is 100 miles in length, from Sheffield to Jasper, Ala., with a branch to Riverton. Pres., Robert E. Tod, 45 Wall St., New York.

SEABOARD AIR LINE.—This company is arranging to operate three steam vessels between Richmond, Va., and Baltimore, Md., via the James River and Chesapeake Bay route. It is the intention to have the service in operation by Dec. 1.——Work on the company's large new freight depot at Atlanta began this week. General Manager Winder says that, when completed, it will be the largest storeroom in the south. By the terms of an agreement entered into between the S. A. L. and the Nashville, Chattanooga & St. Louis R. R., the latter road is given the use of half of the space of this depot, in consideration of the use, by the S. A. L., of the tracks of the N., C. & St. L. into the city of Atlanta.

Northwest.

CANADIAN PACIFIC.—Numerous rumors have been current recently concerning the utilization of the new Chicago & Lake Superior road by the Canadian Pacific as an entrance line into Chicago. From Portage, the tracks of the Wisconsin Central would be used temporarily to Minneapolis, St. Paul and Duluth. This route would be shorter by 32 miles than any existing line between Chicago and St. Paul, and Chicago would gain another connection with the Pacific Coast.

DULUTH, PIERRE & BLACK HILLS.—At a meeting held on Nov. 20 at Yankton, S. Dak., the citizens of that place appointed as a committee to act in the matter of securing the proposed line from Minneapolis to the Black Hills, Mayor M. J. Jarvis, ex-Mayor A. Boller, Senator D. S. Smith, and others. From the determined manner in which the scheme is being promoted by the people of the various cities to be benefited by such a road in would seem that success may attend their efforts.

ILLINOIS CENTRAL.—It is reported that a branch from La Salle, Ill., to Ottawa is contemplated by this road, and that surveyors have been at work between the two cities for some time. The distance is only 20 miles. Ch. Engr., J. F. Wallace, Chicago.

ISHPEMING & MARQUETTE.—Press reports state that it has been officially announced that the contract for building the much-talked-of ore railway in northern Michigan has been let to Winston Bros., of Minneapolis. The contract includes the construction of 15 miles of road, terminal tracks, freight and passenger depots, and an ore dock, and is to be completed by June 15, 1896. The contractors are already on the ground, the work being started at Marquette.

MANITOWOC TERMINAL.—Work is progressing rapidly at the Manitowoc end of this Wisconsin Central extension, a large force of men being at work on the slip and docks. It is now definitely known, a press report states, that the car ferry for which the Flint & Pere Marquette Ry. is receiving bids, is for service between Manitowoc and Ludington, and preparations are being made for terminals at Ludington, as well as in the former city. The designs of the new ferry boat for this line call for four tracks capable of carrying 30 cars, and to cost about $275,000.

MUNISING.—E. H. Scott, Gen. Man., La Porte, Ind., writes us concerning the new road in northern Michigan mentioned in last week's issue, that the final location has been made. The route is as follows: From Munising, on Grand Island Bay, Lake Superior, southward up the Anna River, and westward to an intersection with the Chicago & Northwestern Ry., near Little Lake Station; branching off to the northeast from near the crossing of the Duluth, South Shore & Atlantic, and running parallel with the coast, and five or six miles from it, to Grand Marais, Mich., with a southeasterly branch running near to or into Manistique, a total length of 100 miles. The right of way has been obtained from the bay to the Northwestern R. R. The grading has been completed for 13½ miles, and about seven miles of track has been laid, including that at the terminals on the bay. All work is being done by the company on its own account.

Southwest.

ALVIN, BRAZORIA & WESTERN.—A despatch from Fort Worth, Tex., states that sufficient money has been raised to complete a preliminary survey of this newly-projected line. The right of way is partially secured.

ARANSAS HARBOR & NORTHERN.—A circular letter has been issued by the promoters of this railway, which is to extend northward from Aransas Pass, Tex., requesting the counties along the proposed route to send delegates to a meeting to be held at Cuero, Tex., on Dec. 5. The purpose of the meeting will be to raise the necessary funds for the construction of the road. The road is projected as far as Hays county, a distance in a direct line of about 175 miles. T. B. Wheeler, of Aransas Pass, is the chief promoter of the new line.

CALVERT & BRAZOS VALLEY.—S. W. Parish, Calvert, Tex., an incorporator of the above railway, noted in our issue of Nov. 14, writes us that no organization beyond the election of a board of directors has been made, but that the construction of the road is practically assured. The citizens of Calvert have already subscribed $35,000 of the $40,000 they propose to raise. The balance of $30,000 necessary to build the road will be secured by a joint note signed by the citizens of Calvert. The right of way has been obtained, and the contracts for grading will be let as soon as the above-mentioned $40,000 has been subscribed. The length of the road is 12 miles.

DENISON & NORTHERN.—An early resumption of the work on this project is looked for. Ch. Engr., D. T. McDonough, Ardmore, Ind. T.

KANSAS CITY, FORT SCOTT & MEMPHIS.—A despatch from Webb City, Mo., states that the contract for constructing the extension from that city southeast through Jasper county, 8½ miles, has been let to Mussleman & Barclay, of Kansas City. The surveys have already been made and the contract calls for the completion of the grading by Jan. 1. Ch. Engr., D. Bontecou, Kansas City, Mo.

MISSOURI, KANSAS & TEXAS.—Press reports from Texas tell of important extensions to be made by this company. It has been unable to gain access from San Marcos to San Antonio over the tracks of the International & Great Northern, and in consequence the company is reported to have determined to built a 50-mile extension between the above cities. A second project is a branch from some point near Coupland, on the main line, to Austin, the capital of the state, a distance of about 20 miles. Ch. Engr., J. W. Petheram, Denison, Tex.

WARREN.—Grading on 11 miles of the lumber road which is being built westward from Warren, Tex., is completed, and rails are laid for five miles of this distance. C. A. Epping, Warren, Tex., is managing the enterprise.

WICHITA VALLEY.—An extension from Seymour, the present terminus of this road, to Abilene, Tex., on the Texas & Pacific, is likely to be undertaken in the not far distant future. It is said that this portion of northwestern Texas is rich agriculturally, and is a very large stock-raising country, and that the success of such an extension would be certain. The distance from Wichita Falls to Abilene, via Haskell, the proposed route is about 110 miles. Gen. Supt., J. V. Goode, Fort Worth, Tex.

Rocky Mt. and Pacific.

MONTANA.—A recent report on the progress being made on this road says that there are now at work, including engineers, graders, bridge builders and tie cutters, about 175 men. The road is virtually graded for a distance of 25 miles from its junction with the Northern Pacific, and when spring opens 45 miles of it will be graded and ready for the rails. In the first 25 miles, piles for 25 bridges are set, and piling can continue all winter. By next April there will be 45 miles of the road completed and ready for the rails, and only 12 miles will remain to Castle, the goal of the project.

Foreign.

MEXICAN CENTRAL.—A Kansas City despatch says that J. H. Hampson, of that city, President and General Manager of the Mexico, Cuernavaca & Pacific Ry., has been awarded the contract for building the Guadalajara extension of the above road to Ameca, a distance of 50 miles. Final documents regarding the work have been signed by President A. A. Robinson, of the Mexican Central system. Fifteen cars of railroad construction outfit are en route from El Paso to Guadalajara, where they are due to arrive next week. Work will then be pushed vigorously forward, with the intention of inaugurating traffic on the new line by June 1, 1896.

STREET AND ELECTRIC RAILWAYS.

CONWAY, MASS.—E. E. Davis, of Northampton, Mass., has been engaged to make surveys for the Conway Electric Ry. to Deerfield and Greenfield, and possibly to Ashfield and Plainfield, 12 miles. W. G. Avery, of Conway, is interested.

BOSTON, MASS.—Edward B. Price, Treas., North Attleboro, Mass., writes us that the electric lines of North Attleboro, Pawtucket, Attleboro, etc., have been

combined as the Interstate Consolidated St. Ry. The roads, which are 24 miles long, are all in operation. Capital stock, $400,000; bonds, $250,000. Pres., Marsden J. Perry, Providence, R. I.

MILFORD, CONN.—Albert B. Hill, of New Haven, Conn., has completed surveys for the Milford Electric Ry. from Saugatuck to Burn's Point, Merwin's Point and Woodmont, 10 miles, estimated to cost $7,000 a mile. Frederick L. Tibbals, of Milford, is interested.

WATERBURY, CONN.—It is reported that the management of the New York, New Haven & Hartford R. R. Co. will within a few days decide on an electrical equipment for the Waterbury, Meriden & Cromwell branch.

WINDSOR LOCKS, CONN.—The Windsor & Suffield Tramway Co., incorporated in 1893, with a capital stock of $50,000, proposes to build its projected electric railway from this city to either Rainbow or Poquonock, at an estimated cost of $30,000. David Henney, Pres. Hartford & West Hartford Horse R. R. Co., Farmington, Conn.; H. C. Douglas, Windsor Locks, and Wm. R. Hurd, Bristol, Conn., are interested.

AUBURN, N. Y.—The Auburn Inter-Urban Electric R. R. Co. has applied for permission of the council to construct its road on a number of streets. F. B. Ives, Cy. Clk.

BATH, N. Y.—The Corning & Painted Post Electric Ry. Co. is reported as considering the question of extending its road to Bath and Hammondsport. Man., C. W. Prince, Corning.

BROOKLYN, N. Y.—Frederick W. Dunton, Pres., 106 Fulton St., New York, writes us that surveys have been made for the Kings, Queens & Suffolk R. R. Co.'s electric road, 10 miles long, from Brooklyn to Far Rockaway. The company is now waiting for the authority of the state railroad commissioners to build the line. As soon as this is received the work will be begun. This road was noted in our issue of last week. Ch. Engr., O. F. Balston, Eagle Bldg., Brooklyn.

NEW YORK, N. Y.—The Third Ave. R. R. Co. has purchased the 42d St., Manhattanville & St. Nicholas Ave. R. R. It is reported that the Third Ave. R. R. Co. will equip its new line, which will be about 25 miles long, either with the cable or the conduit electric system. John B. Underhill, Secy. Third Ave. R. R. Co.

NIAGARA FALLS, N. Y.—The Niagara Falls St. Ry. Co. has applied for permission to construct its electric railway on a number of streets. S. F. Arkush, Cy. Clk.

OSWEGO, N. Y.—Geo. N. Burt, Pres., Oswego, writes us that the Oswego St. Ry. Co. and the Fulton & Oswego Falls St. Ry. Co. are to be consolidated under the name of the Ontario & Suburban Ry. Co., the combined lines making a road 12 miles long from Oswego to Battle Island, Oswego Falls and Fulton. The lines, which are now operated by horse power, will be equipped with electricity. The surveys will be completed in a few days. The right of way is substantially secured, and the capital for construction has all been subscribed. The contract, although not yet let, will probably be awarded to Belden & Seely, 121 Liberty St., New York, and Syracuse, N. Y.

WILSON, N. Y.—Peter B. Secord, Wilson, writes us that right of way has been secured and an application for a charter will soon be asked for an electric railway, 35 miles long, between Wilson, Pekin and Buffalo.

MEADVILLE, PA.—The council has granted a 35-year franchise to the Meadville St. Ry. Co. for an electric road 6½ miles long.

PHILADELPHIA, PA.—It is stated that the Holmesburg, Tacony & Frankford Electric Ry. Co. proposes to extend its road to Trenton.

WEST CHESTER, PA.—It is stated that about $650,000 has been subscribed to aid in the construction of the electric road from Philadelphia to Cochranville, Lancaster, West Chester, etc. Surveys are now being made. Wm. S. Kirk, of West Chester, is interested.

FREDERICK, MD.—Bids were to be received about Nov. 25 for grading the Frederick & Middletown Electric Ry., 10 miles long, and for furnishing ties. Pres., Geo. W. Smith, Frederick.

HAGERSTOWN, MD.—It is stated that work will be begun at once on the construction of the Hagerstown & Potomac Electric Ry. Co.'s Funkstown branch. Dr. E. A. Wareham and Samuel H. Long, of Hagerstown, are interested.

MERIDIAN, MISS.—Arrangements are being made, it is reported, to begin the reconstruction of the Meridian St. Ry. into an electric line and the erection of an electric light plant at once. Pres., J. L. Handley, Meridian; A. W. Hall, Pittsburg, Tenn., is interested.

VICKSBURG, MISS.—It is reported that the Vicksburg Electric Transit & Light Co. is about to award contracts for two 125-HP. generators, two 150-HP. high-speed engines and five cars of 225 HP. each. Secy., C. R. McFarland.

HARTFORD, KY.—It is stated that Col. A. J. Casey, of the Owensboro "Inquirer," Owensboro, Ky., is receiving bids for the construction of an electric railway from Hartford to Beaver Dam. Surveys have been completed.

COLUMBIA, IND.—It is reported that the granting of franchises to the Fort Wayne, Lake Everett & Columbia City Electric Ry. Co. has been completed, and work on the road will soon be commenced. The road, which will be 25 miles long, will be completed within six months. Pres., C. E. Everett, Fort Wayne.——The Huntington, Columbia City & Ligonier Electric Ry. Co. has also been granted a franchise for a 40-mile road, work on which will soon be begun. Valoroes Brown, W. F. McNaggy and Thos. R. Marshall, of Indianapolis, are interested.

FORT WAYNE, IND.—The Fort Wayne Electric Ry. Co. has petitioned for permission to extend its road to a point on the St. Joe River, 4½ miles. Supt., L. D. McNutt.

GOSHEN, IND.—It is reported that the Indiana Electric Ry. Co. has executed a mortgage for $500,000, which will be used in constructing the road to Elkhart, 70 miles. Gen. Man., J. Clyde Power.

KNIGHTSTOWN, IND.—The Newcastle & Knightstown Electric Ry. Co. has been organized to build a line 17 miles long at an estimated cost of $170,000. T. J. Smith, of Indianapolis, is interested.

ALLEGAN, MICH.—F. A. Makin, Gen. Man., Allegan, writes us that the Saugatuck, Holland & Southampton Ry. Co. is now in the market for full equipment for its proposed electric railway, 38 miles long, from Holland to Saugatuck, Fenville, Allegan, etc., and that the contracts will be let at once. The capital for the construction has all been secured. Pres., E. J. Herrington, Holland, Mich.

DETROIT, MICH.—It is stated that no contracts have yet been awarded for the power house and passenger cars for the electric railway being built by Strathern Hendrie, 28 Newberry Bldg., Detroit, from this city to Birmingham, Mich.——Vincent Field, 8 Moffat Bldg., and H. Kean, of Detroit, have petitioned the supervisor for an electric road in Grosse Point township.

CHICAGO, ILL.—The Chicago City Ry. Co. is considering plans for extending its electric road in the downtown district of the city. Supt., M. K. Bowen.

CAPE GIRARDEAU, MO.—L. A. Joseph, Cape Girardeau, writes us that the Citizens' St. Ry. Co. is a reorganization of the Cape Girardeau St. Ry. Co. It is possible that the road will be changed into an electric line and extended 10 miles to Jackson. Capital stock, $20,000.

KANSAS CITY, MO.—An electric road is to be constructed on Wyandotte St., with branches covering a total of 15 miles of streets, at an estimated cost of about $1,200,000, according to local papers. T. J. Fry is interested.

SAN RAFAEL, CAL.—It is stated that work has been begun on the Tamalpais Mountain R. R., seven miles long. The road will be built from Mill Valley to the summit of Mount Tamalpais up a grade of about 7%. Engr., Gus. D. Avery, San Rafael. S. B. Cushing, of San Rafael, is interested.

ELECTRIC LIGHT AND POWER.

BELFAST, ME.—We are informed that the Petit Manan Land & Improvement Co., Opera House Block, Belfast, proposes to construct an electric light plant for Petit Manan, a suburb of this city. W. F. P. Fogg, Gen. Solicitor, Belfast.

BOSTON, MASS.—It is reported that the Milford, Holliston & Framingham Electric Ry. Co. has purchased property bordering on the Charles River, on which a power house to furnish 500 HP. will be built. W. B. Ferguson, of Malden, Mass., and H. E. Bullard, of Holliston, Mass., are interested.

ALBANY, N. Y.—Press reports state as follows: Information has been received here of a contract for the equipment of the Erie Canal with electrical power. It is understood that the Erie Canal Traction Co. has entered into a contract with the Erie Construction Co. to install a system for canal-boat propulsion from Buffalo to Albany at an expense of $2,250,000, and that work will proceed as the work upon the canal enlargement advances. The Erie Canal Traction Co. is the owner of the franchise authorized by recent legislation to be given to the Cataract General Electric Co., the rights of that company for towing purposes only having been assigned to it. It is believed that the capitalists who control the Cataract General Electric Co. also control the Erie Canal Traction Co. The Cataract General Electric Co. also controls the Cataract Electric Co. of Rochester, the Cataract Electric Co. of Syracuse, the Cataract Electric Co. of Utica, and the Cataract Electric Co. of Albany, each of which has a capital stock of $1,000,000. It is stated that these various organizations will expend in equipment in the neighborhood of $6,500,000. The electric power to be introduced will be generated at Niagara Falls. The superintendent of public works and the state engineer and surveyor will be asked to ratify the equipment contract.

NIAGARA FALLS, N. Y.—It is stated that arrangements are being made by the Niagara Falls & Lewiston R. R. Co. to construct a power plant at the lower falls. Pres., J. M. Brinker, Niagara Falls.——It is reported that Secretary Rankine, of the Falls Power Co., states that proposals have been invited for the enlargement of the wheel pit to accommodate three more turbines, to work in conjunction with three new dynamos, capable of producing 5,000 HP. each. The work is to completed within six months.

BOONTON, N. J.—The Boonton board of trade has recommended that the council purchase or put in an electric light plant, at an estimated cost of $15,000.

PHILADELPHIA, PA.—The Fairmount Park Commissioners have been instructed to secure estimates for an electric light plant.

PITTSBURG, PA.—Bids are asked until Dec. 3 for lighting the city with electricity, gas, etc., for four years; bonds, $50,000 and $28,000. Edward M. Bigelow, Dir. Pub. Wks.

WILKINSBURG, PA.—No bids were received Nov. 16 for furnishing 65 arc lights. James G. Storer, Borough Clk.

SISTERSVILLE, W. VA.—It is reported that Geo. H. Potter and others have applied for an electric light franchise.

SHEFFIELD, ALA.—We are informed that the council has granted E. F. Enslen and others a franchise for an electric light plant and water-works. The water will be pumped by electric power. No plans have yet been prepared. The city will sell $50,000 in 6% gold 30-year bonds. Address C. B. Ashe, Sheffield.

NEW ORLEANS, LA.—J. J. Cohen and M. Ber have applied for a franchise for an electric light and power plant.

PORT GIBSON, MISS.—An election is to be held Dec. 2 to vote on the question of constructing an electric light plant and water-works.

OWENSBORO, KY.—J. E. Dawson, Cy. Engr., writes us that the city has voted to issue bonds for electric lights, sewers, etc. The matter is now in the courts awaiting a definite decision.

BLOOMINGTON, IND.—It is stated that the trustees of the university have decided to put in an electric light plant, at a cost of $3,000. Wood Robinson is one of the trustees.

FRANKFORT, IND.—The council has appointed a committee to consider the advisability of constructing an electric light plant and water-works, at an estimated cost of about $30,000.

BENTON HARBOR, MICH.—J. A. Cranford, Cy. Clk., writes us that nothing has yet been done towards the construction of an electric light plant for this city, reported in our issue of Nov. 14.

CHICAGO, ILL.—The Central Cicero Improvement Association has been organized by the residents of Oak Park to secure better light service and water supply. F. R. Lindop, Washington Boulevard, Oak Park, Chicago, is interested.

MANITO, ILL.—Joseph Seely, of the light committee, writes us that nothing will be done in regard to an electric light plant until next spring.

PROPHETSTOWN, ILL.—The question of electric lighting is being discussed, according to reports.

CONNEAUT, O.—This place has voted to issue $20,000 in bonds for an electric light plant, according to reports.

MOUNT STERLING, O.—The following bids for constructing an electric light plant were received Nov. 12 by John W. Hanawalt, Cy. Clk.; Engrs., E. P. Roberts & Co., Cleveland:

Bidder.	Electric plant.	Steam plant.	75 HP. engine
Erie City Iron Works, Erie, Pa	.....	$3,425	$175
*Russell & Co., Massillon, O	.....	2,843	85
Ball Engine Co., Erie, Pa	.....	3,803	90
Watertown Steam Eng. Co., Watertown	.....	3,688	90
J. K. Rugg & Co., Cincinnati, O	.....	4,350	75
Buckeye Engine Co., Salem, O	.....	3,755	80
Taft & Dole, Columbus, O	.....	3,843	155
Devere Electric Co., Cincinnati, O	$3,359	3,650	120
Franklin Electric Co., Kansas City, Mo.	4,035	.....	...
Franklin Electric Co. (30 K-W.)	3,788	.....	...
*Fort Wayne Elec. Corp., Fort Wayne	3,133	.....	...

* Awarded contract.

BIWABIK, MINN.—D. W. Freeman, Village Recdr., writes us that an election will be held Jan. 3 to vote on the question of incorporation as a city. If this carries, and bonds can be sold, it is hoped to put in an electric light plant.

ROCHESTER, MINN.—The National Electric Co., of Eau Claire, Wis., and the J. G. Robinson Ideal Engine Co., of St. Paul, Minn., have been awarded contracts for furnishing engines and for enlarging the electric light plant, at a cost of $3,350.

SAUK RAPIDS, MINN.—R. Cronk, Village Recdr., writes us that an election was called for Nov. 19 to vote on an issue of $25,000 in bonds for an electric light plant.

ABILENE, KAN.—Norris Bros., of Kansas City, Mo., have been granted a 21-year franchise for an electric light plant. It is reported that work will be begun in about 20 days.

MARLIN, TEX.—R. M. & J. M. Odell, of this city, who were recently granted a franchise, are having surveys and estimates made for an electric plant to provide 1,000 to 1,500 lights.

UNIONVILLE, MO.—This place has voted in favor of electric lights and water-works.

COLTON, CAL.—It is stated that an election is soon to be held to vote on the question of issuing bonds for an electric light plant.

NIAGARA FALLS, ONT.—Press reports state as follows: It is decided that work on the power plant for the Canadian Niagara Co. will begin within four months. It is to be pushed with all haste, so that power can be furnished within the time named in the franchise—1897. The plant on the Canadian side of the river will be considerably larger than that on the American side.

PORTNEUF, QUE.—An electric light plant is to be put in at this place, according to reports.

NEW COMPANIES.—Power Transmitter Co., Jersey City, N. J.; $1,000,000; Patrick Eagan, Geo. Bissell, New York, N. Y.; Herbert F. Hatch, East Orange, N. J.

Pacific Electric Co., Tacoma, Wash.; $2,000; W. L. Dean, A. F. Epperson, Charles Bedford.

Skeen Electric Switch & Signal Co., St. Louis, Mo.; $5,000; A. F. Gast, C. F. Joy, Ferdinand Gast.

Safety Arc Lamp Hanger & Improvement Co., St. Joseph, Mo.; $25,000; John L. Zeidler, Francis L. Meyer, E. P. Snowden.

Union Power Co., Cleveland, O.; $50,000; H. N. Chamberlain, J. Henry White, F. C. Phillips, George C. Wing, Morris S. Towson.

Electric Heating Co., Portland, Me.; $500,000, with $250 paid in; Pres., John S. Ryder, Boston, Mass.; Treas., John F. Wood, Boston, Mass.

Beatrice Electric Co., Beatrice, Neb.; $100,000, with full amount paid in; John A. Horbach, Paul W. Horbach, Victor G. Santry, J. E. Smith, A. L. Maxwell.

American Electric Forge Co., Newark, N. J.; $100,000, with $10,000 paid in; Geo. D. Burton, Boston, Mass.; Alfred C. Garsia, New York, N. Y.; Barnard J. Fredericks, Arlington, N. J.

Standard Electric Car & Power Co., Portland, Me.; $500,000, with $400 paid in; to develop a certain invention of improvement for electrical railways; Pres., John K. Wightman, of Boston, Mass.; Treas., George C. Hackett, Wakefield, Mass.

Acetylene Light, Heat & Power Co., Boston, Mass.; $2,000,000, with $1,000 paid in; to manufacture the calcium carbide and materials for light, heat and power purposes; Frank N. Lewis, Chas. C. Mickle, Philadelphia, Pa.; Henry C. Blair, Jr., Edgewater Park, N. J.

National Electrical Exposition Co., New York; to hold exhibitions of all productions of electrical and kindred industries; $10,000; Harrison J. Smith, Marcus Nathan, Robert B. Corey, Stephen A. Douglas, William F. Welse, William A. Stafelman, C. O. Baker, Jr., John A. Seeley, George I. Porter, New York.

BRIDGES.

BUFFALO, N. Y.—The Buffalo Engineering Co. has prepared plans for an iron bridge 186 ft. long and 100 ft. wide over the Erie Canal at Porter Ave. Bids will be asked in a few weeks for its construction. Designing Engr., Frank M. Sylvester.

GREAT NECK, N. Y.—The following bids were recently received by the highway commissioners for constructing a trestle bridge over Udall's Pond, in this place:

	Oak piles.	Spruce.
P. J. Mara, Flushing, N. Y.	$4,665	*$3,765
W. H. Jenks, New York	4,800	3,800
R. Monks, New York	4,600	3,900
Wrought Iron Bridge Co., Canton, O.	.....	3,990

* Awarded contract.

CAMDEN, N. J.—Bids are asked by the bridge committee until Dec. 11 for constructing an iron bridge over Cooper Creek in Delaware township. Samuel Jaquillard, Chn. Com.

PITTSBURG, PA.—The Overgrade Bridge Co. has

been incorporated to build a bridge over Big Beaver Creek in Beaver county; capital stock, $600,000; Treas., James G. Corcoran, Pittsburg.

WASHINGTON, D. C.—Gen. W. P. Craighill, Ch. Engrs., has recommended the reconstruction of the Long Bridge, at an estimated cost of $531,365, although only $150,000 can be secured for the fiscal year ending June 30, 1897.

BENWOOD, W. VA.—Trimble & Miller, Pittsburg, Pa., write us that a company has been organized and a charter secured for a steel bridge from Bellaire, O., to Benwood. The bridge will be for highway and street-car traffic. The structure will be 2,500 ft. long, including approaches, and will be built for double tracks. Erection will be commenced early next spring.

RALEIGH, N. C.—The city authorities last week closed an agreement whereby the Seaboard Air Line is to build a bridge across Morgan St. extension, the bridge to have stone abutments at each end, a 36-ft. roadway, with two 8-ft. walks. The bridge, which the city has been endeavoring to get the railway company to build for years, will now be built at once. The company was represented by John H. Winder, Gen. Man., Portsmouth, Va.; W. Z. Blake, Cy. Engr.; H. F. Smith, Cy. Clk.

FERNANDINA, FLA.—The bridge committee has been authorized to secure estimates for a bridge at the Marsh Road.

DAYTON, O.—F. M. Turner, Cy. Engr., writes us that nothing can be done in reference to building bridges in this city until power is secured from the legislature to issue bonds. It is proposed to construct two bridges to cost about $250,000, as reported in our issue of last week.

INDIANAPOLIS, IND.—The board of public works has received the following bids for building the Meridian St. bridge over Pleasant Run, a plate girder, 75 × 30 ft. roadway, and two 6-ft. sidewalks, girders 7 ft. 6 ins. deep; B. J. T. Jeup, Acting Cy. Engr.:

Groton Bridge & Mfg. Co., Groton, N. Y.	$5,500
Massillon Bridge Co., Massillon, O.	5,140
La Fayette Bridge Co., La Fayette, Ind.	5,080
Variety Iron Works, Cleveland, O.	5,040
C. F. Hunt & Co., Indianapolis, Ind.	5,010
Chicago Bridge & Iron Co., Chicago, Ill.	5,000
Wisconsin Bridge & Iron Co., Milwaukee	4,999
J. D. Adams & Co., Indianapolis, Ind.	4,995
Penn Bridge Co., Beaver Falls, Pa.	4,994
Toledo Bridge Co., Toledo, O.	4,945
Jas. B. Nelson, Indianapolis, Ind.	4,940
Wrought Iron Bridge Co., Canton, O.	4,928
Shiffler Bridge Co., Pittsburg, Pa.	4,590

DETROIT, MICH.—Vincent Field, 8 Moffat Bldg., Detroit, proposes to build an iron bridge over the Detroit River from Grosse Point to Belle Isle.

SALINA, KAN.—Bids are asked until Dec. 7 for constructing three iron bridges, 50 and 70 ft. long and 16 ft. wide. D. J. Addison, Clk. Saline County.

TOPEKA, KAN.—Wm. H. Barnes, Cy. Engr., writes us that on Nov. 4 Shawnee county voted to issue $150,000 in bonds to construct a Melan arch bridge. The designing engineer has not yet been named.

DENVER, COLO.—Bids are asked until Dec. 14 for constructing a steel bridge over the Arkansas River, in Prowers county, two sureties of $10,000 each; also for constructing a bridge over the Blue River, in Summit county, two sureties of $5,000 each. H. A. Sumner, State Engr., Denver.——Proposals for plans for an iron bridge over the Gunnison River, in Gunnison county, were received by the state engineer, Nov. 23. The available fund is $4,500.

HOUSTON, TEX.—Bids are asked until Dec. 9 for constructing an iron bridge over Buffalo Bayou at Shepherd's Dam. John G. Tod, County Judge, Houston.

SHERMAN, TEX.—We are informed that the city will build a steel bridge, 70 ft. long, with a roadway 18 ft. wide. Engr., A. Z. Nash.

ASTORIA, ORE.—The Northwest Construction Co. has awarded the contract for constructing a drawbridge over the Young's River, in this city, to Robt. Wakefield and Wm. Jacobson, of Portland, at a cost of about $20,000. The bridge will be 4,000 ft. long, and principally of trestle work.

VENTURA, CAL.—Geo. C. Powers, County Surv., writes us that the contract for a plate girder steel trestle bridge 160 ft. long, with 16-ft. roadway, ¼-in. buckle plate, concrete and asphalt, as advertised in Engineering News, has been awarded to the Los Angeles Bridge Co., at $6,864, the bids being as follows:

Pacific Bridge Co., San Francisco	$10,650
Wrought Iron Bridge Co., Canton, O.	$8,760 and 8,856
San Francisco Bridge Co., San Francisco	13,600
Los Angeles Bridge Co., Los Angeles	$6,764 to 6,907
Excelsior Bridge Co., Los Angeles, Cal.	7,502
Healy, Tibbetts & Co., San Francisco.	$9,470 and 9,970
Thompson Bridge Co., San Francisco, Cal.	9,840

BUILDINGS.

BELFAST, ME.—The Petit Manan Land & Improvement Co., Opera House Block, Belfast, is to build a large hotel and about 200 houses next summer. Several cottages and a club house have been built. Capital stock, $2,500,000. Pres., E. F. Hanson; Treas., G. C. Kilgore, Gen. Solicitor, W. F. P. Fogg, Belfast.

BOSTON, MASS.—J. Mulcahey, 43 Milk St., Boston, has prepared plans for a $130,000 brick church building.——M. T. Sears, 70 Kilby St., Boston, has prepared plans for a $200,000 office building for T. C. Russell.

PROVIDENCE, R. I.—Bids are asked until Dec. 2 for constructing a brick addition to the third police station on Wickenden St. Archs., Martin & Hall, 502 Industrial Trust Bldg., Providence; David Burton, Chn. Com.

BINGHAMTON, N. Y.—Bids are asked until Nov. 30 for constructing a building for the Binghamton state hospital; two bonds of $20,000 each. I. G. Perry, State Arch., Albany; Alex. Cumming, Chn. Bd. Trustees.——The supervisors have appointed a committee of three to secure plans and estimates for a new jail or penitentiary. O. J. White, Supervisor.

BUFFALO, N. Y.—Bids are asked until Dec. 6 for installing a heating and ventilating plant in the new high school building in Masten Park. R. G. Parsons, Secy. Pub. Wks.

IRVINGTON, N. Y.—The Ardsley Casino Co. has been incorporated to acquire real estate and to construct club buildings, piers, houses and stables in Irvington; capital stock, $200,000; directors, Edwin Gould, Cyrus Field Judson, Philip Schuyler, Lucien C. Warner and Charles C. Worthington, of Irvington; A. L. Barber, John D. Archbold, Samuel Thomas, Fred L. Eldridge, Walston H. Brown and George H. Mairs, of New York; and John T. Terry, of Tarrytown.

NEW YORK, N. Y.—Bids are asked until Dec. 17 for furnishing and putting in place the fireproof shutters in the first and second stories in the U. S. Appraiser's warehouse in this city, as stated in our advertising columns. Address Wm. Martin Aiken, Supervising Architect, Washington.——Bids are asked until Dec. 21 for the steel and ironwork for the fourth to the tenth stories, inclusive, and the roof, etc., for the appraisers' warehouse, New York. About 11,600,000 lbs. of steel and iron will be needed. The bids for this work, which were all rejected, were published in our issue of Oct. 24. Wm. Martin Aiken, Supervising Arch., Washington, D. C.——Bids are asked by the supervising architect, at Washington, until Dec. 7, for improving the ventilating apparatus of the post office building in this city. Postponement from Nov. 23.——McKim, Mead & White, 160 Fifth Ave., have prepared plans for a $300,000 hall for Columbia College.——R. H. Robertson, 160 Fifth Ave., has prepared plans for a $400,000 stone dwelling for C. W. Lippitt, at Newport, R. I.——Henry Corn, in conjunction with the United Society of Shakers, of Lebanon, N. Y., will erect a 12-story terra cotta and stone front apartment house, on a plot 100 ft. sq., on the northeast corner of 58th St. and Sixth Ave., to cost $500,000.

POUGHKEEPSIE, N. Y.—Bids are asked until Dec. 18 for constructing an addition to the Hudson River State Hospital. I. P. Perry, State Arch., Albany; Amasa J. Parker, Pres. Bd. Managers, Poughkeepsie.

SYRACUSE, N. Y.—Chas. M. Warner, of Syracuse, is interested in the construction of a projected hotel, 15 stories high, on the site of the Dixon House, at West Jefferson and South Salina streets.

PITTSBURG, PA.—Bids are asked until Dec. 7 for the erection of a fire engine house at the corner of Webster Ave. and Wandless St.; bond, $15,000. J. O. Brown, Dir. Pub. Safety.

CLOUDLAND, N. C.—W. E. Ragsdale, of Cloudland, will build a 234-room hotel on Roan Mountain, near this place, to cost $160,000. The building stone and hard wood, which the plan calls for, to be used in the construction of the building, can be found in abundance in the immediate vicinity, which facts enable the projector to expect a building which would cost ordinarily in a city about $200,000 to be erected here for the sum named.

SALISBURY, N. C.—The city authorities, at a meeting held Nov. 22, decided to build a combined city hall, station house and fire department building. The structure will be of brick and a site on Lee St. has been purchased.

JACKSONVILLE, FLA.—Arrangements are being made to prepare plans for a new armory, after which bids will be asked. Chas. Marvin, Chn. Bd. County Comrs.

CANTON, O.—Bids are asked until Dec. 23 for a heating and ventilating system for the South Market school building. A. O. Slentz, Clk. Bd. Education.

WARREN, O.—It is reported that the Trumbull county commissioners have decided upon plans for heating the new court house here, and will soon ask for bids for putting in the equipment. A system without fans has been decided upon. The foundations for the new building are about completed.

INDIANAPOLIS, IND.—Press reports state as follows: This city is preparing to urge congress to appropriate $2,000,000 for a new federal building. Committees have been appointed representing the city and the commercial bodies, and these will accompany Postmaster Sahm to Washington soon after congress meets. The 13 congressmen from the state have promised to co-operate in the movement. Four years ago congress appropriated money for the purchase of ground for the building.

TELL CITY, IND.—Bids are asked until Dec. 10 for constructing a city hall. H. J. Stuebrk, Cy. Clk.

CHICAGO, ILL.—C. N. Crowen has prepared plans for a $115,000 apartment house on Indiana Ave., near 22d St. Bids for the construction will soon be asked. F. A. Britton and P. F. Reynolds are interested.

MILWAUKEE, WIS.—Ferry & Clas, of Milwaukee, have been awarded first prize for plans for the new $400,000 historical library building for this city. It has been decided by the commission that a prize of $500 be awarded to each of the following firms: Van Brunt & Howe, Kansas City, Mo.; Charles S. Frost, Chicago, Ill.; Peabody & Stearns, Boston, Mass.; H. C. Koch & Co., Milwaukee.

CHEROKEE, S. DAK.—It is reported that a meeting of the commission will be held Dec. 13 to decide upon receiving bids for the construction of the $800,000 Iowa state insane asylum in this city. Archs., Josslyn & Taylor, Cedar Rapids, Ia.

ATCHISON, KAN.—Bids will be received in January for constructing a boiler house, water tower, pump-house, etc., for the Soldiers' Orphans' Home, estimated to cost about $50,000. Bids were recently received for this work, but were rejected. Wallace & McNamara, of Des Moines, Ia., were the lowest bidders, at about $44,000. John Seaton, Chn. State Bd. Pub. Wks.; J. C. Holland, State Arch., Topeka.

GALVESTON, TEX.—Geo. H. Law, Jr., County Clk., writes us that on Nov. 14 the commissioners' court of Galveston county reconsidered its action of a previous date by which the erection of a new court house was indefinitely postponed.

WATER-WORKS.

BELFAST, ME.—W. F. P. Fogg, Gen. Solicitor, writes us that the Petit Manan Land & Improvement Co. has completed a large wharf and 16 miles of streets near this city, and that water-works, sewers, etc., will be added in the spring; capital stock, $2,500,000; Pres., E. F. Hanson; Treas., G. C. Kilgore.

BELCHERTOWN, MASS.—Efforts are being made to secure the construction of works in this place.

HAVERHILL, MASS.—The contract for the construction of the Millvale stone masonry dam and reservoir, which was awarded to Donato Cuozzo, of New York, in May, was completed Nov. 23. The stone was furnished by the Rockport Granite Co., of Rockport, Mass. Freeman C. Coffin, 53 State St., Boston, was the chief engineer.

MILLBURY, MASS.—The Millbury Water Co. is reported as considering plans for extending its service to West Millbury.

AKRON, N. Y.—J. F. Witmer, of Buffalo, has been engaged to prepare plans for works.

ALBANY, N. Y.—The bids for steampiping to connect the new boilers and pumps were as follows: P. J. Sweeney (awarded contract), $8,081; Albany Brass & Iron Co., $9,404; Jas. Hunter, $10,495; Skinner & Arnold, $11,383; E. P. Bates, $12,897.

ATTICA, N. Y.—The Maplewood Water-Works Co. was incorporated Nov. 25 with a capital stock of $50,000 by F. C. Stevens, A. A. Smith, E. T. Gay, and others of this place. F. C. Stevens has subscribed for nearly the entire capital stock.

BOONVILLE, N. Y.—B. A. Capron, Clk., writes us that water has just been found, but that nothing has yet been decided in regard to works.

CALLICOON DEPOT, N. Y.—The residents of this village are reported as considering plans for supplying the village with water.

CENTRAL VALLEY, N. Y.—Geo. Cornell writes us that the Central Valley & Highland Mills Water Co. is constructing works, and that the plant is nearly completed. W. H. Cowan, Pres.

MIDDLETOWN, N. Y.—The commissioners have unanimously passed a resolution stating that an additional water supply is needed.

SARANAC LAKE, N. Y.—At the special election Nov. 19 the citizens voted to issue $10,000 in bonds for extensions of the works.

SAUGERTIES, N. Y.—The litigation with the water company has been settled by the village purchasing the plant for $76,000.

WEEDSPORT, N. Y.—F. C. Reynolds, of the Moravia Water-Works Co., was in town recently, and, with the village trustees, visited a large spring about four miles distant. It is expected that a franchise will be granted the company to construct works in this place.

DEAL BEACH, N. J.—The Coast Water & Sewer Co. was incorporated Nov. 20 with a capital stock of $100,000, commencing with $25,000, by Edwin P. Benjamin, of Asbury Park; A. S. Campbell, Elizabeth, N. J.; A. S. Page, C. B. Benson and D. B. Page, of Oswego, N. Y. We are informed that plans are about completed, but that no contracts have yet been awarded.

ASHLAND, PA.—Alexander Potter, of New York, has reported that the proposed new reservoir dam, noted Nov. 14, can be built for about $14,000, and will store 30,000,000 gallons of water.

CANONSBURG, PA.—The St. Clair Water Co. is reported to have completed arrangements for extending its main to Marshalsea, the work to be commenced about Dec. 1.

CARLISLE, PA.—The directors of the gas and water company are reported as considering plans for a filter plant, which it is proposed to put in at an early date.

LATROBE, PA.—The North Irwin Water Co., was incorporated Nov. 21 with a capital stock of $5,000, to operate in North Irwin; Treas., Vin. E. Williams, Latrobe.

LEBANON, PA.—Geo. W. Hayes, Cy. Engr., has made surveys for a new reservoir, estimated to cost $70,000 to $100,000.

READING PA.—The water board has adopted a resolution instructing the superintendent to prepare preliminary plans for the improvement of the Antietam water supply and to report at the January meeting.

FRANKLIN, VA.—It is stated that J. P. Gay and J. R. Knight have been appointed a committee to investigate the cost of works.

ELKINS, W. VA.—The city is reported about to issue $25,000 in bonds for works.

DOTHAN, ALA.—It is reported that W. C. & B. R. Pilcher will construct works at this place.

SHEFFIELD, ALA.—At a meeting of the council Nov. 20 E. F. Enslen and others were granted a franchise for works and an electric light plant. We are informed that $50,000 in 6% gold 30-year bonds will be issued. No plans have been made.

PORT GIBSON, MISS.—A special election will be held Dec. 2 to vote on the question of water-works and electric lights.

MORRISTOWN, TENN.—Geo. S. Crouch, Secy. Comrs., writes us that the contract with J. N. Hazlehurst & Co., of Atlanta, Ga., has not been forfeited, as reported some time ago, and that the construction of the plant is about to be commenced and will probably be completed in about three months.

FALMOUTH, KY.—Bids are asked until Dec. 18 for the construction of works. P. H. Porter & Co., Louisville, Engrs.

BOND HILL, O.—Contracts for works are reported to have been awarded as follows: Ryan & Link, pipelaying, $2,661; Addyston Pipe & Steel Co., pipe, $9,718; Bourbon Copper & Brass Works, hydrants and valves, $2,004.

FRANKFORT, O.—It is thought that works can be constructed for about $20,000, and a committee has been appointed to investigate the question.

GENEVA, O.—There is considerable talk of securing water-works, owing to a recent fire.

NORWALK, O.—L. E. Chapin, Consult. Engr., Canton, O., has submitted a report recommending the construction of a reservoir and embankment.

YELLOW SPRINGS, O.—At the second election to vote on the question of water-works the proposition was defeated by six votes.

BOONVILLE, IND.—A. H. Kennedy, of the Rockport water-works, recently addressed a meeting of the citizens in regard to works at this place, and a committee was appointed to investigate the question. Clamor Pelzer, C. C. Ferguson and G. H. Hazen are interested.

WALKERTON, IND.—A committee has been appointed by the Walkerton Water-Works Co. to negotiate for a site for a pumping station and stand-pipe. T. J. Wolfe, Pres.; Will Clem, Secy. W. W. Co.

CHARLOTTE, MICH.—We are informed that an election will be held the last of this month to vote on the question of putting in a new pump.

WAYNE, MICH.—A meeting was held Nov. 23 to take action in regard to the construction of works. It is proposed to secure a supply from artesian wells and pump it to a steel stand-pipe. The two railway companies are expected to pay one-half the operating expenses of the plant.

ASTORIA, ILL.—It is stated that an election will soon

be called by the village board to vote on the question of works.

CHICAGO, ILL.—Bids are asked until Nov. 30 for the purchase of $500,000 of 5% water certificates. O. D. Wetherell, Cy. Comptroller.

MANTENO, ILL.—The contract for the stone tower and tank and a water main in Chestnut St. has been awarded to J. R. Blatchford, of Kankakee, Ill., at $3,800. It is expected that bonds will be issued and the system completed next summer.

NUNDA, ILL.—I. M. Mallory, Clk., writes us that bids are about to be received for works, including a stand-pipe, reservoir, artesian well and three miles of 8 to 4-in. pipe. C. C. Watson, Pres.

SHELBYVILLE, ILL.—It is reported that this place will probably issue $30,000 in bonds for works.

ST. ANNE, ILL.—The citizens are agitating the question of works.

VERMONT, ILL.—An election will be held in December, according to reports, to vote on the question of issuing $15,000 in bonds for water-works.

UNION GROVE, WIS.—It is stated that the company recently organized at this place has secured a pumping plant and reservoir, and is laying mains. Pres., Wm. Hardy; Secy. and Treas., Dr. Bassett.

KEOSAUQUA, IA.—The council has been petitioned to secure works. It is stated that nearly every one is in favor of the project.

MACKEY, IA.—It is reported that $10,000 in bonds will be issued for works. Martin Ahrens is interested.

OSAGE, IA.—The question of water-works is being agitated, according to press reoprts.

MONTEVIDEO, MINN.—Bids are asked until Dec. 2 for the construction of a well and connecting same with the water mains. J. M. Severens, Village Recdr.

RED WING, MINN.—Bids are asked until Jan. 7 for furnishing and erecting a 2,000,000-gallon pumping engine. S. J. Willard, Secy. Comrs.

ST. CLOUD, MINN.—Dr. C. N. Hewitt, of the state board of health, has reported the water supply in this city as unsatisfactory.

NEWTON, KAN.—Bids are asked for sinking a test well from 1,000 to 3,000 ft. deep. P. M. Hairington, Chn. Com.

DUNBAR, N. DAK.—Nels Lunneborg, Town Clk., writes us that $2,000 in bonds have been voted for sinking an artesian well, but that the bonds have not yet been sold. No contract has yet been awarded. Several other townships in this county have recently voted bonds for the same purpose.

FARGO, N. DAK.—The citizens have voted in favor of the proposed issue of $30,000 in bonds for water-works and sewer extensions.

FAYETTE, MO.—The citizens are reported as trying to secure works.

MARCELINE, MO.—The citizens of this place were recently reported as agitating the question of works. The Santa Fe railway company is sinking wells about three miles from the city for use in the city, and it is reported probable that efforts will be made to have the service extended through the city for domestic use and fire protection. Hiram Long, Cy. Clk.

UNIONVILLE, MO.—The board of aldermen were to receive bids Nov. 25 for engineering services for the proposed water-works and electric light plant, for which $18,000 in bonds were recently voted. G. H. Gardner, Cy. Clk.

MARLIN, TEX.—R. M. & J. M. Odell, who were recently granted a franchise, are reported as having plans and estimates made for water-works to supply 1,200 families, an electric light plant of 1,000 to 1,500 lights, and three miles of sewers.

WEIMAR, TEX.—The proposed water-works plant, noted last week as having been voted for at the recent election, is reported as estimated to cost $6,000. J. C. Kindred, Mayor.

KENDRICK, IDAHO.—Bids will be asked again, according to reports, for the purchase of the $11,000 in bonds recently voted for water-works, the only bid received for the bonds having been rejected.

ROSS FORK, IDAHO.—Bids are asked until Dec. 26 for water supply of 600 cu. ft. a second for Fort Hall Indian Reservation. T. B. Teter, U. S. Indian Agt., Ross Fork; D. M. Browning, Comr., Washington, D. C.

KALAMA, WASH.—E. N. Coryell, Clk., writes us that H. Orchard has been granted a franchise, and will put in works; population, 800.

SEATTLE, WASH.—R. F. Stewart, Cy. Clk., writes us that an election will be held Dec. 10 to vote on the proposition to issue $1,250,000 in bonds for a water supply from Cedar River.

LOS ANGELES, CAL.—The West Los Angeles Water Co. was incorporated Nov. 20 with a capital stock of $1,000,000, commencing with $1,000, to construct reservoirs, ditches, etc., in the Cahuenga Valley, and to supply water for irrigation and domestic purposes in this city; incorporators, F. R. Dorn, W. B. Akey, L. D. C. Gray and J. M. Pirtle, of Los Angeles, and W. H. Hallett, of St. Louis, Mo.

NEVADA CITY, CAL.—Bids are asked until Dec. 12 for the purchase of $60,000 in bonds recently voted for new works. The construction of the plant will be commenced as soon as possible. Fred M. Miller, Engr., Grass Valley, Cal.; T. H. Carr, Cy. Clk.

PORT COLBORNE, ONT.—Jas. H. Smith, Jno. C. McRae and Jas. W. McCoppen have been appointed a committee to investigate the question of works, which Vaughan M. Roberts, Engr., St. Catharines, roughly estimates can be put in for $12,000.

SUMMERSIDE, P. E. I.—W. K. McKay, Town Clk., writes us that the question of water-works will probably be made an issue at the election in February. Nothing has yet been done; population, 3,000.

IRRIGATION.

OVERTON, NEB.—We are informed that the Platte Valley Irrigation Co. is enlarging the capacity and improving its canal. The main ditch is 16 miles long, and supplies about 40 miles of laterals. When completed it will irrigate about 4,000 acres. The work is to be done by the stockholders on the co-operative plan, so there are no contracts to be let. Engr., A. C. Koenig, Grand Island, Neb.

MINIDOKA, IDAHO.—F. J. Mills, State Engr., Boise City, writes us that the survey made by T. D. Babbitt, of Boise City, for two canals along the Snake River, noted in our issue of Nov. 14, was made for the state. Maps and plans are now being prepared. There is no intention or possibility of any construction being done by the state, and any possible construction will be done by private companies. No appropriation has been made nor has anything definite been agreed upon.

CHEYENNE, WYO.—Press reports state as follows: Brockway Bros., who are backed by Denver and Cheyenne capitalists, are laying out a 14-mile ditch from the La Piele, which will irrigate 8,000 acres of land in the Fort Fetterman bottom. It is the intention of the company to build this ditch next spring, carrying it across the Platte by flumes, so as to reclaim about 6,000 acres more close to Douglas.——A. W. Phillips & Co. are building a large stone dam at Irvine to store water for the irrigation of about 8,000 acres.

NEW COMPANIES.—Blunck Construction Co., Davenport, Ia.; $100,000; to construct waterways and canals in the state; F. T. Blunck, George Klind, H. J. Witt.

North River Irrigating Canal & Water Power Co., Cheyenne, Wyo.; $12,300; Robt. A. Day John Robinson, John Henderson.

Witcher Portable Dam Co., Salt Lake City, Utah; $50,000; to lease and purchase lands, put in dams under two patents, the right to which has been acquired by the company, and promote the cultivation of lands generally; Pres., Gilbert S. Peyton; Vice-Pres., W. E. Hubbard; Secy. and Treas., Philip S. Witcher. These, with Arthur B. Witcher and Mamie F. Witcher, constitute the board of directors.

SEWERAGE.

BELFAST, ME.—W. F. P. Fogg, Gen. Solicitor, Petit Manan Land & Improvement Co., Opera House Block, Belfast, writes us that the company proposes to construct a sewer system in the spring at Petit Manan, a suburb of this city. About 16 miles of streets were laid out this fall. Capital stock, $2,500,000. Pres., E. F. Hanson; Treas., G. C. Kilgore.

ARLINGTON, MASS.—Contracts will probably be awarded this season for constructing a system, at an estimated cost of $100,000, voted for Nov. 14. E. S. Fessenden is a member of the committee. Engr., Geo. A. Kimball, Exchange Bldg., Boston; Frank W. Hodgden, Cy. Engr.

BELMONT, MASS.—It is reported that E. A. W. Hammatt, Engr., Boston, has been engaged to prepare plans for a system.

TAUNTON, MASS.—Wm. R. Billings, Secy. Comn., writes us that the city will endeavor to secure an appropriation of $128,000 for pipe and brick sewers, to be built in 1896.

NIAGARA FALLS, N. Y.—Bids are asked until Nov. 29 for constructing a 30-in. steel riveted tube, 220 ft. long, to be used as an outlet sewer and garbage dump. W. W. Read, Cy. Engr.; S. F. Arkush, Cy. Clk.

SKANEATELES, N. Y.—The construction of sewers is being considered.

BAYONNE, N. J.—The construction of a sewer through wards 1 and 5 to the Kill von Kull, at a cost of about $50,000, is being discussed.

CAPE MAY, N. J.—It is reported that the council has awarded a contract to L. E. Miller, at $1,019, for constructing a sewer on Stockton Ave. and Jefferson St. It is the intention of the council to extend the system over the entire city just as soon as the finances of the city will permit.

DEAL BEACH, N. J.—Edwin P. Benjamin, Pres. Coast Water & Sewer Co., Asbury Park, writes us that plans have just been completed for sewers and water-works for Deal Beach, and that no contracts have yet been awarded. The company was incorporated Nov. 20, with a capital stock of $100,000, $25,000 of which is paid in. Incorporators, Alfred S. Campbell, Elizabeth, N. J.; Alanson S. Page, Cadwell B. Benson and David B. Page, Oswego, N. Y.

JERSEY CITY, N. J.—Bids are asked until Dec. 2 for constructing eight short sewers, 12 to 24 ins. in size, and 345 to 1,110 ft. in length. Geo. T. Bouton, Clk. Bd.

RED BANK, N. J.—It is reported that the town commissioners have decided to construct a system, at an estimated cost of $50,000.

WILDWOOD, N. J.—Bids are asked until Dec. 3 for constructing a system. Check, $2,000. Latimer R. Baker, Mayor; Wm. R. Prentiss, Borough Clk.

JACKSONVILLE, FLA.—Owing to inability to sell bonds, the trustees have rejected the bids recently received for sewer materials, and it is stated that no work will be done this winter. R. N. Ellis, Supt.; A. F. Harley, Cy. Engr.

OWENSBORO, KY.—J. E. Dawson, Cy. Engr., writes us that the city has voted to issue bonds for sewers and other public improvements, but the matter is now in the courts, and it is not definitely known when work will be begun.

AKRON, O.—Bids are asked until Nov. 30 for constructing sewers in three streets. Frank C. Wilson, Cy. Clk.

CHILLICOTHE, O.—Plans are being considered for a system.

WARREN, O.—F. S. Chryst, Cy. Solicitor, writes us that at present no sewage disposal plant will be constructed.

EVANSVILLE, IND.—Bids are asked by the board of public works until Dec. 7 for constructing a sewer. Elmer E. Clarke, Clk. Pub. Wks.

INDIANAPOLIS, IND.—The board of public works has directed B. J. T. Jeup, Acting Cy. Engr., to prepare new plans for the Pogue's Run brick sewer, which will be 18,000 ft. long, about 25 ft. in diameter at its widest place, and is estimated to cost $720,000.

SHELBYVILLE, IND.—It is stated that a company has been incorporated to construct a system.

TERRE HAUTE, IND.—H. S. Bosler, Cy. Engr., writes us that John A. Cole, Old Colony Bldg., Chicago, Ill., has been engaged by the council as consulting engineer to plan a system. Work will be carried on as rapidly as possible so as to have everything in readiness to begin construction in early spring.

ALTON, ILL.—E. E. Rutledge, Cy. Engr., writes us that the people will vote in April on the question of issuing bonds for constructing 5,600 ft. of 10 to 5-ft. brick sewer, average cut 8 ft., estimated cost, $20,000. The contract will be let in April.——The Abbott-Gamble Contracting Co., 620 Chestnut St., St. Louis, Mo., has been awarded the contract for constructing a brick intercepting sewer in Front St. at $4,500.

BLUE ISLAND, ILL.—Bids are asked until Dec. 2 for constructing brick and pipe sewers in eight streets. Engr., P. R. Fletcher, 208 Western Ave., Blue Island; Fred. Hohmann, Village Clk.

MADISON, WIS.—O. S. Norsman, Cy. Clk., writes us that the following bids were received Nov. 19 for 2,900 ft. of 24-in. pipe sewer, 12-ft. cut, and 1,360 ft. of 22-in. pipe sewer, 8-ft. cut, as advertised in daily papers:

Geo. Kraft, Madison, Wis.	$12,000
Nicholas Quinn, Madison, Wis.	16,700
K. A. Smith, Madison, Wis., Faribault, Minn.	19,500

MILWAUKEE, WIS.—G. H. Benzenberg, Cy. Engr., is about to prepare plans for a flushing plant for the Kinnickinnic River. The plant will include a pumping station and a tunnel 1½ miles long under the 17th ward to the lake.——The board of public works has been directed to construct sewers in several streets.

GLENWOOD, IA.—It is reported that the people of this place have decided to construct a system next year. H. Evernham, Jr., of the Commercial Hotel, Glenwood, is interested.

KANSAS CITY, KAN.—It is probable that new bids will be asked for the construction of a sewer in district No. 16. R. E. Elea was the lowest bidder, at about $30,000, as noted in our issue of Sept. 26. C. A. Ellis, Cy. Engr.

FARGO, N. DAK.—It is stated that the city has voted to issue $30,000 in bonds for the extension of the sewer system and water-works.

COLUMBIA, MO.—Prof. H. T. Cory, of the University of Missouri, Columbia, writes us that nothing definite has yet been done toward the construction of the proposed 6,000 ft. of 24-in. pipe sewers. The question will probably be voted upon at the election in April. Wm. G. Barrett, Cy. Clk.

ST. LOUIS, MO.—Bids are asked until Dec. 6 for constructing 1,530 ft. of 9 and 8-ft. brick sewers in Clarendon Ave. Robt. E. McMath, Pres. Bd. Pub. Improvements.

SHERMAN, TEX.—We are informed that the city proposes to build sewers, although no plans have yet been prepared. Engr., A. Z. Nash, Sherman.

GARBAGE DISPOSAL.

READING, PA.—Press reports state that the board of health contemplates the erection of a garbage crematory.

COLUMBUS, O.—The contract for constructing a garbage crematory at Columbus Barracks has been awarded to Walter Collins, 199 North 21st St., Columbus, at $1,839. D. W. McGrath, 1079 Summit St., Columbus, bid $1,963.

EVANSVILLE, IND.—The contract for a garbage crematory has been awarded to the Engle Sanitary & Cremation Co., of Des Moines, Ia., at $9,000. The bids were published in our issue of Nov. 7.

STREETS AND ROADS.

WEST HARTFORD, CONN.—Bids are asked until Nov. 30 for macadamizing a road. E. T. Stanley, Selectman.

WESTPORT, CONN.—Bids are asked until Dec. 3 for macadamizing in State St. Robt. H. Coley, Selectman, Westport.

BAYONNE, N. J.—The contract for the flagging, curbing and grading of Avenue C from West Eighth St. to the Morris Canal, a distance of more than three miles, has been awarded to James J. Cogan, at $20,150. Work will begin immediately. Operations must be completed within 45 days.

PHILADELPHIA, PA.—Bids are asked until Dec. 3 for paving portions of a number of streets. Theo. B. Stubb, Health Officer.

NEW ORLEANS, LA.—Bids are asked until Dec. 2 for brick paving in Claiborne St. Chas. R. Kennedy, Comptroller.

ABERDEEN, KY.—Purdin & Rist, of Aberdeen, Ky., and Daulton & Shanks, of Adams county, have been awarded the contract for constructing a road from Aberdeen to the Adams county line.

LEXINGTON, KY.—Bids are asked until Dec. 11 for brick paving in two streets. H. T. Duncan, Mayor.

AKRON, O.—Bids are asked until Nov. 30 for brick paving in Park St. Frank C. Wilson, Cy. Clk.

YOUNGSTOWN, O.—It is reported that the county commissioners have decided to advertise for bids for macadamizing Seceder Corners Road, at an estimated cost of $5,800.

BRAZIL, IND.—Bids are asked until Dec. 9 for constructing a gravel road in Parke and Clay counties. Claude Ott, Supt. Construction, Brazil.

NILES, MICH.—The question of a large amount of paving next year is being considered.

ALTON, ILL.—Bids are asked until Nov. 30 for 1,000 sq. yds. of macadam paving, estimated to cost $8,000. E. E. Rutledge, Cy. Engr.

RACINE, WIS.—O. Burlingame, Cy. Engr., writes us that College St. will not be paved this season.

WACO, TEX.—The county commissioners have been petitioned to hold an election to vote on the question of improving the roads of McLennan county.

SPOKANE, WASH.—The question of paving Riverside St. with brick, cedar or stone is being considered. W. H. Wiscombe, St. Comr.

MANUFACTURING PLANTS.

MOOSUP, CONN.—The Sterling Dyeing & Finishing Co. is about to erect a new engine and boiler house, in which will be placed an engine of some 2,500 HP., according to reports.

NORWICH, CONN.—A five-story stone building, available for any manufacturing purpose, is offered for sale by the Chelsea Savings Bank, of this city.

BUFFALO, N. Y.—It is reported that a $1,000,000 steel plant will soon be established in this city, which will give employment to 1,000 men. Richard H. Stafford is interested.

GIBSONVILLE, N. Y.—It is reported that Isaac

Hoffman's Silver Lake paper mill, at this place, is to be converted into a bicycle factory.

HILLBURN, N. Y.—The Ramapo Iron Works are reported as soon to erect a large addition to their car shops.

NYACK, N. Y.—It is reported that C. L. Seabury & Co. have been considering an offer from New London, Conn., to remove their boat-building plant to that place.

SILVER SPRINGS, N. Y.—The Empire Salt Co., of Warsaw, is soon to expend $12,000 upon its plant in improvements, which will include four 450-HP. boilers, new brine tanks, etc.

PASSAIC, N. J.—The Flint Construction Co. is about to begin an $18,000 addition to the Passaic Print Works.

BLAIRSVILLE, PA.—The Victor Mfg. Co. is reported to have decided to triple the present capacity of its plant.

BROWNVILLE, PA.—The Monongahela Chair Factory Co., with a capital stock of $10,000, recently purchased ground in this place, and will erect a plant to manufacture chairs. About 200 persons will be employed.

CHESTER, PA.—A silk factory will soon be established in this city, according to reports. R. E. Ross is interested.

CORAOPOLIS, PA.—It is understood that an extensive glass plant is to be erected at this place. Samuel W. Black & Co. are interested.

HYDE PARK, PA.—It is stated that an iron plant is to be erected at Hyde Park, Allegheny township.

PHILADELPHIA, PA.—The machine shop of Tinius, Olsen & Co., occupying the lower floor of building at northeast corner of 12th and Buttonwood Sts., was recently damaged by fire to the extent of $10,000; fully insured.

PHILADELPHIA, PA.—A charter has been granted to the Way Mfg. Co. to manufacture cotton and woolen goods; capital stock, $50,000; Thos. J. Jeffries, E. Eldridge Smith, Charles M. McCloud, and others, are interested.——It is reported that plans have been completed for a large factory building to be erected by Pilling & Madeley, at Ann St. and Clinton Ave., three stories, 50 × 150 ft., steel and fireproof construction.

PITTSBURG, PA.—The National Galvanizing Works will soon erect, near Bissell Station, two buildings, each to be 50 × 300 ft.

PITTSBURG, PA.—It is stated that the Penn saw works of C. P. Lippert & Son will be removed to Millvale borough, where a three-story brick building, 120 × 200 ft., is being erected.

CHARLOTTE, N. C.—Arrangements are being made for the erection of an additional cotton mill at this place, where there are already seven in operation and two now building.——The Alpha cotton mill will soon put in a weave plant.

CHARLOTTE, N. C.—Mr. Latta, owner of the bulk of the property in the suburban town of Dilworth, on the outskirts of Charlotte, will erect a large building, to be constructed with the view of accommodating various small manufacturers of different articles, similar to such buildings in big cities. He will let the contract for the work. The plans for buildings have not yet been made.

WILKESBORO, N. C.—A wood-working factory is to be built at this place. R. A. Spainhour is interested.

FORT MILL, S. C.—A company is being organized to build another large cotton mill at this place.

AUGUSTA, GA.—The Warwick Mills is enlarging its plant, and will add 1,700 spindles and 150 looms at an early date.

TRUSSVILLE, ALA.—The Trussville Furnace & Mining Co., R. D. Smith, Gen. Man., will soon purchase, according to reports, a blowing engine, battery of boilers, etc., and an outfit for 200 coke ovens.

LOGANSPORT, IND.—Lewis Lehle, 812 Schiller Bldg., Chicago, Ill., has prepared plans for a new brewery to be erected at this place.

MIDDLETOWN, IND.—A press report states that the Irondale Steel & Iron Co. will fully equip the tinning department of its plant, so as to consume the entire output of the rolling plant of six mills, making eight double sets and two single sets in the tinning house.

WYANDOTTE, MICH.—The East Liverpool China Co. has purchased land upon which it will erect a plant for the manufacture of china, delft ware and fine pottery, etc. New machinery will be purchased. Address J. B. Ford.

COLCHESTER, ILL.—The preliminary steps have been taken by Buckley, Pursley & Co., Peoria grain dealers, to erect a grain elevator in this city.

GALESVILLE, WIS.—The George Rall Mfg. Co. has completed its warehouse, and will soon erect a main building, to be 42 × 60 ft., and to be equipped with wood-working machinery.

MILWAUKEE, WIS.—It is understood that A. H. Manske & Co. will build a brewery at the corner of 18th and Wine Sts., to have a capacity of 12,000 barrels a year.

IVES' SIDING, RACINE COUNTY, WIS.—It is stated that John O'Laughlin, of Austin, Ill., will build a $55,000 plant to crush stone and manufacture curbstone and gutter supplies at this place.

SAN ANTONIO, TEX.—A press report states that the movement inaugurated by the Business Men's Club to build a cotton mill at this place is meeting with encouragement, and the promoters feel confident of success.

SEATTLE, WASH.—It is stated that Dr. Thornton, of Ferndale, is at the head of a movement to form a company to establish a flax-scutching mill, and to be known as the Puget Sound Flax Fiber Co.; capital stock, $40,000.

ASTORIA, ORE.—It is reported that negotiations are pending between Dr. Alfred Kinney and Eastern capitalists with a view to establishing a cotton mill in this city.

YUMA, CAL.—A press report states that a movement is on foot to establish a large smelting plant at or near this place. Jesse R. Grand, of this place, and Judge Richards, of Pueblo, Colo., are interested.

CONTRACT PRICES.

SEWERS.—Champaign, Ill.—The contract for constructing a system of sewers, as advertised in Engineering News, has been awarded to Geo. S. Miller & Co., Ottawa, Ill., the lowest bid being rejected on account of an omission. The work is to be commenced in March. The bids were as follows: C. J. Strahle, Cy. Clk.; Joseph O'Brien, Cy. Engr.; A. N. Talbot, Consult. Engr.:

Bids Received Nov. 15 for Constructing Champaign, Ill., Sewerage System.

Quantities.	John A. Mercier, Detroit, Mich. $50,048.	E. V. Johnson Co., Chicago, Ill. $50,434.	J. D. Richardson & Co., Lafayette, Ind. $50,604.	Fletcher Bros., N. Baltimore, O. $68,456.	Goodrich Bros., Winchester, Ind. $65,589.	Jas. McClure & Co., St. Paul, Minn. $73,819.	Sheets & Hammond, Dirkcarville, O. $50,044.	Hanlon & Knepper, Sioux City, Ia. $47,005.	Crilley & Forrestal, Milwaukee, Wis. $52,870.	Jenkinson, Nicholson Co., Port Huron, Mich. $53,386.	Geo. S. Miller & Co., Ottawa, Ill. $44,987.	Greenville Const'n Co., Greenville, O. $55,373.	Geo. B. Kelley & Co., Urbana, Ill. $46,262.	Hege & Silbern, Indianapolis, Ind. $57,400.	Wilson, Thatcher Co., Chicago, Ill. $54,028.	Wickham Bros., Council Bluffs, Ia. $54,279.	Adams Bros., Zanesville, O. $52,694.	Jesse Robertson, Terre Haute, Ind. $60,528.	Kelley & Monroe, Portsmouth, O. $56,686.	Jas. H. Roche, Chicago, Ill. $58,764.	M. L. McCarron, Detroit, Mich. $44,045.	Nash & Dowdle, Chicago, Ill. $61,227.
Trenching and backing:																							
Under 6 ft. ..22,485 ft.	$0.12	$0.08	$0.10	$0.15	$0.10	$0.17½	$0.08	$0.07¼	$0.12	$0.12	$0.06	$0.10	$0.08¼	$0.09	$0.13	$0.09	$0.09	$0.13	$0.09	$0.10	$0.05	$0.11
From 6 to 8 ft. 53,010 "	.15	.12	.12	.19	.14	.20	.11½	.08½	.15	.15	.10 4	.17	.09¾	.12	.16	.10	.11½	.20	.14	.17	.09	.17
" 8 " 10 " 37,600 "	.20	.16½	.14	.25	.20	.31½	.17	.14	.20	.17	.15	.21	.17½	.16	.22	.14	.17½	.24	.25	.21	.11	.22
" 10 " 12 " 18,900 "	.25	.21	.22	.37	.24	.39¾	.20	.18	.30	.23	.19 6	.33	.20	.24	.25	.26	.28	.32	.25	.30	.12	.32
" 12 " 14 " 7,450 "	.29	.29½	.27	.57	.33	.56	.31¼	.23	.40	.30	.26	.39	.28	.28	.30	.32	.37	.45	.33	.40	.18	.40
" 14 " 16 " 3,000 "	.35	.39	.35	.77	.45	.71	.44	.33	.50	.36	.33	.50	.35	.31	.35	.44	.52	.65	.42	.55	.23	.49
" 16 " 18 " 850 "	.45	.47	.45	.87	.54	.80	.67	.50	.70	.43	.41	.75	.50	.36	.45	.57	.80	.81	.59	.65	.27	.49
" 18 " 20 " 1,000 "	.55	.55	.45	.99	.70	1.18	.83½	.55	1.00	.50	.48	.90	.75	.40	.55	.75	1.15	.95	.85	.75	.33	.59
" 20 " 22 " 175 "	.68	.70	.45	1.11	.85	1.25	1.17	.75	1.20	.55	.55	1.25	1.00	.44	.85	1.25	1.75	1.20	1.25	.90	.35	.69
Vit. pipe sewer:																						
18-in. .....13,160 ft.	.35	.41	.40	.30	.44	.40¾	.35½	.62	.30	.42½	.34	.30	.35	.35	.30	.34	.36 2	.39	.40	.38½	.33	.48
15 " ..... 530 "	.21	.28	.26	.20	.34	.26½	.23	.21½	.20	.31	.20	.21	.25	.27	.21	.29	.20	.27	.29	.28½	.29	.28
14 " ..... 2,960 "	.17	.25	.24	.19	.29	.25	.21 4	.19½	.20	.30	.19	.20	.23	.26	.19½	.27	.23½	.25	.25	.25	.27	.28
12 " ..... 3,370 "	.15	.21	.20	.16¼	.24	.22	.17	.16½	.15	.22	.16	.15	.18	.23	.17	.18	.18 7	.21	.20	.21½	.22	.21
10 " ..... 6,720 "	.12	.17	.17	.12½	.19	.17½	.1 46	.15½	.11	.17¼	.14	.12	.14	.19	.14	.16	.15 4	.19	.16	.17½	.15	.17
8 " ..... 80,630 "	.07½	.11	.12	.08¾	.16	.13¼	.11	.09½	.08	.12	.09	.09	.09½	.16	.09½	.11	.10 6	.15	.12	.11⅞	.11	.11
6 " ..... 37,060 "	.06	.08	.09	.06½	.12	.10½	.09	.08	.06	.07¼	.08	.07	.07¼	.14	.07½	.09	.08¼	.09	.08	.08½	.06½	.08
Cast iron pipe...20 tons	32.00	35.00	43.00	30.00	30.00	31.00	30.00	30.00	40.00	25.00	27.00	35.00	30.00	33.00	28.00	33.00	27.00	40.00	30.00	35.00	30.00	49.00
Manholes, 8-ft. 239	22.00	21.00	20.00	27.00	35.00	25.50	21.00	21.00	24.00	18.00	22.50	21.00	18.50	25.00	24.00	35.00	19.50	30.00	20.00	19.50	35.00	21.00
For each foot..	3.00	1.00	1.00	1.97	2.00	2.25	.01	1.50	1.50	....	2.00	3.00	.75	3.00	1.65	3.00	4.00	2.00	1.75	1.90	3.50	2.50
Lampholes, 8-ft.. 90	6.00	4.00	4.00	8.00	8.00	4.00	6.00	3.00	3.00	4.00	3.30	4.00	5.75	5.00	5.00	12.00	4.75	5.00	4.00	5.50	3.50	6.00
For each foot..	.15	.20	.50	.20	.50	.14	.01	.10	.10	....	.10	.35	.10	.50	.12	2.00	.50	.50	.50	.13	....	.75
Flush tanks..... 55	30.00	30.00	30.00	34.50	50.00	35.00	25.00	25.00	25.00	30.00	34.00	35.00	28.00	35.00	35.00	40.00	31.00	35.00	30.00	30.00	27.10	44.50

DRAINAGE CANAL.—Chicago, Ill.—The following bids were received for constructing the regulating works for the Chicago Drainage Canal (Eng. News, Nov. 21), as advertised in Engineering News. Bids were called for under five heads: (1) All masonry, ironwork and machinery above elevation, 17.75; (2) all masonry below elevation, 17.75; (3) all concrete below 17.75; (4) excavation, and (5) bear-trap dam metalwork.

Bidder.	1. Lump sum.	2. Per cu.yd.	3. Per cu.yd.	4. Per cu.yd.	5. Lump sum.
Campbell, Dennis & Co.[1]	$286,953	$18.00	$8.00	$1.25	$92,181
Shaller & Schniglau	124,650	11.00	5.00	0.65	60,564
E. D. Smith & Co.[2]	153,900	15.00	9.00	0.75	39,000
Christie & Lowe	120,000	15.00	8.00	1.00	58,000
American Bridge Co.	152,500	18.00	10.00	1.00	57,200
Griffiths & McDermott Co.	154,000	17.50	7.00	1.00	47,400
Detroit Bridge & Ir. Wks.[3]	145,000	14.75	7.50	1.00	49,600

[1] Joliet, Ill. [2] Summit, Ill. [3] Detroit, Mich. All others Chicago.

SEWERS.—Erie, Pa.—The following contracts for pipe sewers were awarded Nov. 21: J. McCormick & Son, of Erie, 548 ft. of 15-in. pipe sewer, straight, $1.59 a ft., and curves, $1.64; 15-in. branch, 70 ft., $1.64; 9-in., in spills, 30 ft., 49 cts.; 6-in., in house connections, 270 ft., 28 cts.; manholes, 2, $38 each; catchbasins, 2, $28 each; average cut, 13.31 ft. Edward Driscol, of Erie, 12-in., 385 ft., $2 a ft.; 12-in. branch, 36 ft., $2.20; 9-in., 10 ft., 25 cts.; 6-in., 288 ft., 40 cts.; manhole, 1, $35; catchbasins, 2, $25; average cut, 14.92 ft. D. O'Brien, of Erie, 12-in., 252 ft., 90 cts.; 12-in. branch, 28 ft., $1.25; 9-in., 25 cts.; 6-in., 180 ft., 25 cts.; manhole, 1, $30; average cut, 13.2 ft. George Platt, Cy. Engr.

WELL.—Ames, Ia.—Prof. G. W. Bissell writes us that W. H. Gray & Co., 29 Illinois St., Chicago, submitted the following bid, Nov. 10, for sinking a deep well for the Iowa Agricultural College: 12-in. pipe to bedrock, probably 100 ft., $6.65 a ft.; 10-in. pipe, 300 ft., $5.94; 8-in. pipe, 400 ft., $5.23; 6-in. casing, 700 ft., $4.52; 5-in. casing, 1,000 ft., $4.64; 4½-in. casing, 500 ft., $4.28. It is proposed to secure a capacity of 8,000 gallons an hour, and the work will be stopped at any point where a test of 24 hours shows that this quantity has been obtained. The prices given include pipe and casing.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

SURVEYS.—Grand Island, Neb.—The council has ordered A. C. Koenig, Cy. Engr., to make a new survey of the entire city.

STREET SIGNS.—Jersey City, N. J.—Bids are asked until Dec. 2 for furnishing and setting up about 2,500 street signs. Geo. T. Bouton, Clk. Bd.

LIGHT FIXTURES.—Rochester, N. Y.—Bids are asked until Dec. 17 for gas and electric fixtures for the new county court house. Lyman M. Otis, Chn. Com.

STREET CLEANING.—Cleveland, O.—Bids are asked until Dec. 18 for cleaning the paved streets and alleys of the city for the year ending Dec. 31, 1896. D. E. Wright, Dir. Pub. Wks.

FIRE ALARM AND POLICE PATROL SYSTEM.—New Orleans, La.—Bids are asked until Dec. 2 for the construction of a new fire alarm and police patrol system. All bidders must have paid the city license fee of $120. Chas. R. Kennedy, Comptroller.

WATER FRONT IMPROVEMENTS.—Philadelphia, Pa.—The finance committee of the councils has decided unanimously to report favorably an ordinance providing for a loan of $2,000,000 for widening Delaware Ave., extending the piers and improving the channel of the Delaware River.

DOCKS.—New York, N. Y.—The dock department is reported about to begin the construction of piers, bulkheads and marginal walls on the west side of the Harlem River, at the junction of Sherman's Creek. The plans were recently approved. The immediate improvement will cost $160,000.

CANAL.—Baltimore, Md.—Bids are asked until Dec. 20 for reconstructing about 30 miles of the Dismal Swamp Canal, as stated in our advertising columns. Bids were recently received for this work, and press reports stated that the lowest was nearly $2,000,000. Address the Lake Drummond Canal & Water Co., 21 S. Gay St., Baltimore.

EXCAVATION.—Tarrytown, N. Y.—A press report states that John D. Rockefeller, of Pocantico Hills, has awarded a contract to have the top of Kykuit Mountain leveled off. This will require the removal of about 80,000 cu. ft. of rock alone. When this is done Mr. Rockefeller will build upon the mountain a mansion which will command an extensive view in every direction.

LAND RECLAMATION.—Chicago, Ill.—Plans for increasing the area of Lincoln Park, Chicago, Ill., by reclaiming about 500 acres of submerged land from Lake Michigan have been ordered prepared by the board of commissioners. Work will be commenced at once making the necessary surveys and soundings, and preparing plans for the sea wall. A. A. Babcock is engineer for the board.

TUBULAR BOILERS.—Washington, D. C.—The following bids were received at the Interior Department, Nov. 15, for installing two tubular boilers at the U. S. Government Hospital for the Insane near this city:

	Amount.	Time, days.
Pettit & Dripps, Washington, D. C.	$2,656	80
Bartlett, Hayward & Co., Baltimore, Md.	2,748	60
Campbell & Zell Co., Baltimore, Md.	2,750	65
Theo. Smith & Bro., Jersey City, N. J.	3,012	70
Lebanon (Pa.) Boiler Fdy. & Mach. Co.	2,200	60
E. J. Codd Co., Baltimore, Md.	2,431	90
Morton, Reed & Co., Baltimore, Md.	1,875	60
Lombard Iron Wks. & Sup. Co., Augusta, Ga.	2,200	60
Brummel, Schmidt & Co., York, Pa.	1,928	60
P. Delaney & Co., Newburg, N. Y.	2,150	60
Oil City Boiler Works, Oil City, Pa.	2,400	85
E. Hodges Co., East Boston, Mass.	2,136	60
S. C. Forsaith Mach. Co., Manchester, N. H.	1,849	60
Brownell & Co., Pittsburg, Pa.	1,829	50
Donegan & Swift, New York, N. Y.	1,900	30
E. Keeler Co., Williamsport, Pa.	1,598	60
James Rees & Sons Co., Pittsburg, Pa.	2,350	40
Smith-Courtney Co., Richmond, Va.	2,349	90
Manhattan Supply Co., New York, N. Y.	3,145	90

DAM.—Rochester, N. Y.—The chamber of commerce is taking steps to push the scheme in the legislature again this winter for the construction of the proposed Mount Morris storage dam across the valley of the Genesee River, estimated to cost, $3,000,000. It is claimed that the Erie Canal is fed by the Genesee River, and that the mill owners of Rochester are deprived of water power during the summer months. The Rochester people maintain that if a great dam is built above Mount Morris, all the surplus water, which is a

positive danger in the spring, could be stored, and by a system of gateways could be used during the summer, always giving the state enough water for the canal, and incidentally giving the mill owners at Rochester the power which they believe properly belongs to them the year around. Heretofore it has been claimed that the state should shoulder the entire expense, but now it is reported that the state is asked only to build dam enough to hold the water necessary for the canal, the mill owners themselves to carry it up higher for their own benefit. The fact that the canal is to be deepened makes it necessary that the state have more water on this level. Hence the hope that the Genesee Storage Dam bill may win at the coming session.

METAL MARKET PRICES.

LEAD.—New York: 3.25 to 3.3 cts. Chicago: 3.05 to 3.07 cts. St. Louis: 2.97 to 3 cts.

BARB WIRE.—Pittsburg: $2.70 and $2.80 for galvanized, and $2.30 and $2.40 for painted in carload and less than carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $13 to $14.50. Pittsburg: $13 to $14.50. Chicago: $13 to $15.50.

TRACK MATERIAL.—New York: angle bars, 1.45 to 1.5 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 to 2.15 cts. with square, and 2.1 to 2.15 cts. with hexagon nuts. Chicago: angle bars, 1.65 to 1.8 cts.; spikes, 1.9 to 2 cts.; track bolts, 2.25 to 2.3 cts. with square and 2.45 to 2.5 cts. with hexagon nuts.

NAILS.—Pittsburg: $2.25 per keg for carload lots and $2.35 for less than carload lots, at mill; $2 and $2.05 for cut nails at mill. Chicago: $2.40 and $2.50 for wire nails, $2.17 and $2.25 for cut nails. New York: $2.43 and $2.53 for wire nails, and $2.18 and $2.28 for cut nails.

RAILS.—New York: $28 at eastern mills and $28.75 at tidewater; old rails, $14.50 to $15 for iron, and $12.50 for steel; light rails, $29; girder rails, $26. Pittsburg: $28 for standard sections of 45 lbs. and over. Chicago: $29 to $31 for standard sections; $28 for light sections; old rails, $17 for iron, and $12.25 to $13 for steel.

STRUCTURAL MATERIAL.—New York: beams, 1.7 to 2.1 cts.; channels, 1.7 to 1.8 cts.; angles, 1.6 to 1.7 cts.; tees, 1.8 to 1.9 cts.; universal mill plates, 1.7 to 1.8 cts.; steel plates, 1.65 to 1.75 cts. for tank, 1.9 to 2 cts. for shell, 2.1 to 2.25 cts. for flange, 2.4 to 2.5 cts. for ordinary firebox, 2.6 to 2.75 for locomotive firebox. Pittsburg: beams, 1.6 to 1.85 cts; channels, 1.6 to 1.85 cts.; angles, 1.4 to 1.5 cts.; tees, 1.6 cts.; Z-bars, 1.6 cts.; universal mill plates, 1.7 to 1.8 cts.; steel plates, 1.6 to 1.7 cts. for tank, 1.7 to 1.75 cts. for shell, 1.8 to 1.85 cts. for flange, 2.5 cts. for ordinary firebox, 2.5 to 4 cts. for locomotive firebox. Chicago: beams, 1.8 to 1.9 cts.; channels, 1.8 to 1.9 cts.; angles, 1.7 to 1.85 cts.; tees, 1.9 to 1.95 cts.; universal mill plates, 1.8 to 1.9 cts.; steel plates, 1.8 to 1.9 cts. for tank, 2.05 to 2.1 cts. for flange, 2.75 to 2.8 cts. for ordinary firebox, 4 to 4.5 cts. for locomotive firebox.

IRON AND STEEL.—The business in general is dull in nearly all lines, and, although the trade papers report the outlook comparatively favorable for improvement in the near future, orders for structural and railway material continue to be made very slowly. At a meeting of the Western Steel Association in Chicago, Nov. 21, it was decided to increase the price on steel castings, based on the increase in cost of iron. Before making any announcement a conference will be held with the Eastern Association, which first made the proposition of an increase. The Merchants' Bar Iron Association held its final session at the same place, and after the meeting W. E. Taylor, President of the Union Iron & Steel Co., Youngstown, O., stated that as the result of the deliberations they simply reaffirmed the old selling prices. There was no advance, but the tendency seems to be upward. The New York "Journal of Commerce" says that the situation in all branches of the trade is unchanged. Buyers of crude material are extremely conservative and apparently indifferent to all explanations of the recent softening of values in some lines, while furnace agents maintain at least a showing of firmness in the face of present heavy production of most varieties of iron. Orders for rails, track supplies, beams, tank, plate and other heavy finished material come in rather slowly. There is considerable business under treaty in some departments, but differences on the matter of prices obstruct the consummation of deals to a considerable extent.

INDUSTRIAL NOTES.

KIER BROS., of Salina, Pa., will add another kiln to their firebrick works.

THE SOUTH HARRISBURG CHAIN WORKS, at South Harrisburg, Pa., is adding 10 new forges to its shops.

THE AMERICAN METER CO., of New York, N. Y., has filed a certificate of increase of its capital stock from $180,000 to $2,000,000.

THE KIRK-YOUNG MFG. CO., of Toledo, O., is a new corporation, with a capital stock of $30,000, organized to manufacture bicycles.

LANO & BODLEY, of Cincinnati, O., have been awarded first prize for their exhibit of a Corliss engine at the Atlanta Exposition.

THE BUFFALO IRON CO., of Nashville, Tenn., has purchased the Southern Iron Co., and will produce the Mannie charcoal softeners.

JAMES LEFFEL & CO., of Springfield, O., have been awarded bronze medals by the Atlanta Exposition for their steam engines and boilers.

THE O. S. KELLY CO., of Springfield, O., has been awarded a bronze medal by the Atlanta Exposition for its exhibit of steam road rollers, etc.

SPECK, MARSHALL & CO., of Pittsburg, Pa., recently fitted up the new plant of the Basic Brick Co., at Johnstown, Pa., with belting, etc.

THE MORTON TIN PLATE CO., of Cambridge, O., has commenced producing roofing tin, which is shipped in continuous rolls, seamed and soldered.

THE NORTHAMPTON CAR WORKS, of Northampton, Pa., recently received an order for 250 gondola cars for the Central R. R. of New Jersey.

THE SCHOFIELD BOLT CO., of Anderson, Ind., was recently incorporated with a capital stock of $120,000, and will operate the Fowler Bolt Works.

THE UNITED STATES CAR CO., of Anniston, Ala., will soon repair and improve its rolling mill, remodel the car works and put the entire plant in operation.

I. MATHESON & CO., New Glascow, N. S., are applying for incorporation with a capital stock of $60,000, to carry on the business of iron founders, machinists, etc.

McILVAIN & SPIEGEL, of Cincinnati, O., are constructing for the Clifton Springs Distillery, several large grain cookers to be 24×8 ft., and of ½-in. hammered steel.

THE PORTSMOUTH MFG. CO., of Portsmouth, N. H., recently sold at auction its plant at South Berwick, N. H., for $30,000; the stockholders were the purchasers.

THE THOMAS MFG. CO., of Springfield, O., manufacturers of agricultural implements, has decided to add a new branch to its business for the manufacture of bicycles.

THE FLORENCE COTTON & IRON CO., of Florence, Ala., will, according to report, settle its indebtedness at once, and the furnace at Philadelphia will then be blown in.

MESSRS. FIELD & GOETZMANN, of Denver, Colo., recently completed an extensive system of coal elevating and conveying machinery for the Porter Fuel Co. of Durango, Colo.

PHILLIPS & McLAREN, of Pittsburg, Pa., have succeeded to the Fisher Engine, Foundry & Machine Works, and will continue the manufacture of shears for all classes of metal.

THE SMEAD FOUNDRY CO., of Toledo, O., is manufacturing a new patent steel tubing, and is turning out about 7,500 ft. per week. New machinery will soon be added and the output increased.

THE ELLIOTT-WASHINGTON STEEL CO., of New Castle, Pa., will, according to report, double the present rolling capacity of its plant. An annealing furnace, pickling house, gang slitter, etc., will be added.

THE EDWARD P. ALLIS CO., of Milwaukee, Wis., recently sold to the Edith furnace department of the Hainsworth Steel Co., Allegheny, Pa., a Reynolds-Corliss blast furnace blowing engine 42 and 84 × 60 ins.

MITSHKON & CO., Chamber of Commerce Bldg., Detroit, Mich., report recent sales of two locomotives to the Clay Lumber Co., of Charleston, W. Va., and cars and a complete outfit to the Tower Logging R. R. Co.

THE NATIONAL TRANSIT CO., of Pittsburg, Pa., has purchased the pipe-line of W. L. Mellon, embracing 325 miles of pipe in Allegheny and Washington counties and 100 miles of main line from Sistersville to Pittsburg.

THE HUGHES SHEAR CO., of Clyde, O., whose plant was recently destroyed by fire has reorganized under the firm name of the Clipper Shear Co. The factory has been rebuilt and equipped with improved machinery.

THE HARRISBURG BOILER & MFG. CO., of Harrisburg, Pa., recently shipped a large hot water boiler to San Antonio, Tex., for the public buildings; and also furnished boilers for the public school buildings of Pittsfield, Mass.

H. A. LOZIER & CO., of Toledo, O., who are constructing a branch of their bicycle works at Toronto Junction, Ont., are having their outfit of machinery made by John Bertram & Sons, Canada Tool Works, Dundas, Ont.

THE CINCINNATI ARCHITECTURAL IRON WORKS CO., of Cincinnati, O., is building the ornamental stairs for the new court house in Pensacola, Fla. The company is also building the framework of the new warehouse at Portsmouth, O.

THE BETHLEHEM IRON CO., South Bethlehem, Pa., has been awarded the contract for nearly 1,200 tons of armor plate for the new Russian battleship "Restislay." There were 14 bidders for the work, and the contract represents nearly $600,000.

ZENOLEUM DISINFECTANT.—The A. H. Zenner Co., Detroit, Mich., has recently received an order for equipping 100 cars for the Lake Shore & Michigan Southern R. R. with its disinfecting apparatus. Over 26 railways are now using this product.

THE TRUSSVILLE FURNACE & MFG. CO., of Trussville, Ala., is negotiating for the purchase of the Trussville furnace and ore mines, and, in the event of success, will enlarge its plant and also build 200 coke owens. R. D. Smith, of Birmingham, is interested.

THE ENTERPRISE MFG. CO., of Columbiana, O., recently sold one of its Columbian steam road rollers to the town of Danielsville, Conn., and has taken orders for spring delivery for five more of these machines for the New England States. The company's large new shop is nearing completion, and will be ready for occupancy early in the new year.

THE BIRMINGHAM SOIL PIPE CO., of Birmingham, Ala., is the name of a new establishment which will soon be in operation in this city. H. T. Beggs and associates, who are the promoters of the enterprise, and owners of the Bessemer Foundry & Pipe Co., will move this plant to Birmingham, and will manufacture iron and soil pipe from 1¾ to 8 ins. in diameter.

THE WESTERN GAS & CONSTRUCTION CO., of Fort Wayne, Ind., has increased its capital stock to $80,000. It is understood that the company contemplates adding necessary buildings for a wrought iron shop department. The company is now engaged on a number of contracts, comprising gas works construction of its special designs, and has a good business in gas engines, valves, and other specialties.

THE KEYSTONE AXLE CO., will erect a plant at Beaver Falls, Pa., for the manufacture of axles and car wheels by a patented process, which will dispense with the use of a steam hammer and other heavy machinery, and use in its place a roller process which, it is claimed, will increase the tensile strength of an axle 8,000 to 10,000 lbs. per sq. in. The building will be 80 × 200 ft., and a steam plant of eight 125-HP. boilers and a large engine will be purchased. Pres., D. C. Clark, 742 Equitable Bldg., Baltimore, Md.

BYRAM & CO., Detroit, Mich., report a decided improvement in their business, and among other orders for foundry equipment the following: 2 furnaces for P. F. Corbin & Co., New Britain, Conn.; 1 furnace for Howe & Dullough Machine Co., Pawtucket, R. I.; complete equipment to the Queen City Radiator Co., Buffalo, N. Y.; 2 furnaces, Lombard Iron Works, Augusta, Ga.; 16-ton ladle, Johnson Co., Johnstown, Pa.; furnace, F. A. Hall, New York city. Among recent shipments are the following: St. Louis Car Co., St. Louis, Mo., third furnace; full equipment, Sault Ste. Marie Pulp & Paper Co., Sault Ste. Marie, Ontario; 70-in. furnace, ladles, etc., Walworth Run Foundry Co., Cleveland, O., for its plant at New Brunswick, N. J.; 70-in. furnace, ladles, etc., Hopedale (Mass.) Machine Co.

NEW COMPANIES.—Alamo Brick Co., San Antonio, Tex.; $50,000; W. H. Hunt, O. P. Birmingham, B. C. Riely, and Frank A. Aid.

Bradford Milling Co., Towanda, Pa.; $50,000; John A. Dayton, Towanda, and John E. Dayton, of Williamsport.

Equitable Silk Co., Paterson, N. J.; $100,000; Lucien Bonheur, Isaac Simon, Gustave Simon and Edward S. Newman.

Mapes-Reeves Construction Co., Brooklyn, N. Y.; $50,000; D. H. Mapes, F. H. Reeves, Charles W. Reeves, of Brooklyn.

Avonmore Foundry & Machine Co., Avonmore, Pa.; $100,000, with $10,000 paid in; Treas., Edward Hall, Leechburg, Pa.

West Michigan Seating Co., Holland, Mich.; $100,000; George P. Hummer, George M. Williams, C. F. Hanchett and W. C. Walsh.

Sayre Metal Co., Sayre, Pa.; to manufacture iron and steel; $30,000, with $3,000 paid in; Treas., A. S. Maurice, Athens, Pa.

Acme Regulator & Carbonic Pump Co., Chicago, Ill.; $10,000; Reymond H. Rudolph, E. F. A. Thielpape and Charles L. Houser.

RAILWAY WORK

noted in this paper is usually awarded to reliable contractors at economical prices. Railway officials are invited to avail themselves of our columns to secure competition for new equipment or construction. We ask especially that early notice of all projected new work be sent us.

22 BIDS; 100 APPLICATIONS.

Champaign, Ill., Nov. 22, 1895.

Engineering News Publishing Co.,
New York city.

Gentlemen: I herewith send you a schedule of the bids received Nov. 15 for constructing a system of sanitary sewers for our city. We received 22 bids and are well pleased with the result of our advertisement in the News. More than 100 applications for specifications were received and a majority of those writing stated that they saw our advertisement in your paper.

Yours truly,
C. J. Strahle, City Clerk.

A CALIFORNIA BRIDGE.

Office of County Surveyor,
San Buena Ventura, Cal., Nov. 18, 1895.

Engineering News Publishing Co.,
New York city.

Gentlemen: Enclosed find statement of bids on steel bridge over the Harmon Barranca, Ventura County, Cal. The contract was awarded at $6,864. Our advertisement in the News was entirely satisfactory and was no doubt the means of getting the matter intelligently before the bridge men. In my judgment it pays. All the bidders agree that I have secured for the county the best and cheapest highway bridge on the coast. I enclose $7.60, the cost of the advertisement.

Yours truly,
Geo. C. Powers, County Surveyor.

(There were seven bidders for this work. In our issue of Nov. 21 we published the 12 bids received for a $10,550 bridge at Abbeville, La., also advertised in Engineering News. Nearly every bridge company and prominent bridge contractor in North America reads this paper, and advertisements inserted in its columns are thus given the greatest possible publicity. ALL BRIDGE WORK SHOULD BE ADVERTISED IN ENGINEERING NEWS.—Ed.)

The Circulation of Engineering News among Prominent Contractors and Contractors' Supply Men Probably Exceeds that of Any Other Five Papers in America.
ADVERTISE YOUR WORK WHERE IT IS GIVEN THE GREATEST POSSIBLE PUBLICITY.